

ANYTIME, ANYWHERE LEARNING
FINAL EVALUATION REPORT OF THE LAPTOP PROGRAM: YEAR 2

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DECEMBER 2001



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EXECUTIVE SUMMARY

This report summarizes the results of an evaluation study of the Year 2 implementation of Anytime, Anywhere Learning (Laptop Program) in Walled Lake Consolidated Schools (WLCS). As in the Year 1 evaluation (Ross, Morrison, Lowther, & Plants, 2000), the overall purpose of this study was to determine the educational impact of providing 5th, 6th, and 7th grade students with access to laptop computers with regard to classroom learning activities, technology usage, and writing achievement.

The goal of the AAL program is to provide students the knowledge, skills and tools to learn anytime and anywhere. In the Year 1 evaluation, the findings showed that Laptop students were using computers more extensively and skillfully in their classrooms than were non-Laptop students. Importantly, usage of the computers was significantly more meaningfully integrated with curriculum in Laptop than in Control classrooms. Laptop students also significantly surpassed non-Laptop students in writing skills, an outcome considered attributable to the increased opportunities to practice writing via the computer.

Year 1 of the Laptop program began with 26 teachers who taught grades 5 and 6. These teachers received ten full days of professional development prior to the 1999-2000 academic year and six one-half day sessions during the year. For Year 2, the 5th and 6th grade students took their laptops with them to the 6th and 7th grades and 8 new 5th grade laptop classrooms were added. Teachers new to the program received after-school and summer training that was equivalent to a 3-hour graduate level course. The training was based on the NTeQ model which provides teachers a framework to develop problem-based lessons that utilize real-world resources, student collaboration, and the use of computer tools to reach solutions. The lessons are typically structured around projects which engage the students in

critically examining community and global issues, while strengthening student research and writing skills.

RESEARCH QUESTIONS

The Year 2 evaluation of the Laptop Program was structured around three primary research questions that focused on classroom practices, student behaviors, and student achievement. Also of interest was the reaction and support of teachers and parents involved with the Laptop Program. The detailed research questions are:

- Is teaching different in a Laptop classroom? To answer this question, observers examined classroom practices to determine if instructional practices in Laptop classrooms were different from those in non-Laptop classes.
- Do students behave differently in a Laptop classroom? By observing and talking to students, observers gauged the level of interest in learning, student attitude toward using technology, and the degree to which students take initiative for their learning as opposed to being dependent on the teacher for constant direction.
- Do students achieve differently in a Laptop classroom? In the present Year 2 Study, we compared Laptop and non-Laptop students in two measures of achievement—writing skills and problem-solving. The analyses also examined learner reliance on technology and cooperative learning strategies as components of their proposed problem-solving strategies.

DESIGN

The Year 2 evaluation period extended from September 1, 2000 through May 30, 2001. The evaluation design was based on both quantitative and qualitative data collected in eight schools (four elementary and four middle) within WLCS. The evaluation involved 40

classrooms distributed across three grade levels: 8 fifth grade, 15 sixth grade, and 16 seventh grade. Participants included students, teachers, and parents involved in Laptop classrooms (with one laptop computer per student) and in Computer-Extended classrooms (with 1 to 5+ computers available for student use).

Comparative analyses were completed for teaching activities and learning outcomes, and descriptive analyses were completed for student, teacher, and parent reactions to both the Laptop Program and Computer-Extended classes. The data set for the evaluation included classroom observations, student achievement writing and problem-solving test scores, student surveys and focus groups, teacher surveys and interviews, and parent surveys.

Two separate observations measures were used to collect observation data: The *School Observation Measure (SOM[®])* and the *Survey of Computer Use (SCU[®])*. *SOM[®]* was based on 60 continuous minutes of observation, divided into about four 15-minute segments. These four observation periods were then summarized on one *SOM[®]* Data Summary form. *SCU[®]* was completed as part of the 60-minute observation sessions, only if students used technology during that time. A total of 55 classroom observations were conducted, with 32 in Laptop classrooms and 23 in Computer-Extended classrooms.

The WLCS's *Writing Scoring Guide* was used to assess prompted writing samples from Laptop and CE students. For this study, 59 Laptop (29 - 6th; 30 - 7th) and 59 CE (29 - 6th; 30 - 7th) writing samples were randomly selected from those taken for the district test for comparative analysis. The District's assessment examines four dimensions of writing: Ideas and Content, Organization, Style, and Conventions.

To assess the ability of students to comprehend problems and formulate solutions, a problem-solving task was devised for this study. Students were given a problem situation,

and were instructed to describe how they would solve the problem, what materials and resources they would use, and whether (and how) they would work with others. Components consisted of “Understands problem,” “Identifies what is known about the problem,” “Identifies what needs to be known to solve the problem,” “Determines how the data need to be manipulated to solve the problem,” “Describes use of technology,” “Describes how to present findings,” and “Collaborative learning.”

The student, teacher, and parent surveys, interviews, and focus groups primarily focused on three areas: (1) to what extent the computers had a personal impact (increased skills – research, computer, learning), (2) to what extent the computers impacted what happens in the classroom, and (3) the benefits, difficulties, and ways to improve the program. The final data set includes: 391 student surveys (257 Laptop; 134 CE), 71 student participants in focus groups (38 Laptop; 33 CE), 8 teacher surveys (all Laptop), 6 teacher interviews (3 Laptop; 3 CE), and 96 parent surveys (66 Laptop; 30 CE).

RESULTS

CLASSROOM OBSERVATIONS

SOM[©] There were two significant differences: Integration of subject areas was *less* ($p < .001$) frequently seen in Laptop than in CE classes. On the other hand, technology as a learning tool was *more* ($p < .001$) frequently seen in Laptop than in CE. Separate analyses by grade yielded essentially the same patterns and significant effects. These analyses show much more similarity between the Laptop and CE classes than was found in the Year 1 comparison between Laptop and Computer-Extended classes.

SCU[©] Laptop classes, as compared to CE classes, had a higher quantity of computers, internet access, more frequent student use of computers, superior student computer skills, and more frequent use of word processing and CD referencing (all p 's < .05).

WRITING PERFORMANCE

Results from a one-way multivariate analysis of variance (MANOVA) showed substantial advantages in writing performance for Laptop over CE students (6th grade: $F(4, 53) = 8.87, p < .001$; 7th grade: $F(4, 55) = 4.133, p < .005$). Overall effect sizes ranged from +0.55 (Conventions) to +1.14 (Ideas and Content).

PROBLEM-SOLVING PERFORMANCE

A MANOVA comparing the means of the two groups on the seven components yielded a highly significant difference, $F(7, 103) = 3.378, p = .003$. Follow-up showed significant advantages for the Laptop group on all seven components. Effect sizes ranged from +0.38 to +0.76.

STUDENT REACTIONS

Student Survey. More Laptop students felt highly positive that their computer skills had increased, and that using the computers improved their skills in writing to some degree, as compared to CE students (both p 's < .001). Additionally, Laptop students tended to rate themselves significantly higher ($p < .05$ or higher) in skills on the majority of software types, as compared to CE students. The CE students tended not to feel as strongly as Laptop students that access to computers increased their interest in learning ($p < .001$) or in earning better grades ($p < .05$).

When the students were asked what they would change about using computers at school, Laptop students indicated the desire for a different brand of laptop, and computers that

were lighter and easier to carry. Common responses by CE students included getting newer/faster computers and having a computer for all students.

Student Focus Groups. Laptop students indicated that the best things about having the computer were: easy access to online resources, ease of creating and editing work, and ability to make assignments look much better. The CE students stated that the best part was that it is easier than writing assignments with paper and pencil, that research is easier, and that they like the spell-checker. Laptop students indicated that the worst aspect of having the laptop was dealing with technical difficulties and carrying it to and from school. For CE students, the worst part was waiting to use a computer, forgetting to save work, and experiencing technical difficulties.

TEACHER REACTIONS

Teacher Survey. The eight Laptop teachers all agreed that the program experience increased their personal ability to: use basic computer applications, create lessons that integrate student use of computers, and integrate technology into lessons that were previously taught without computers. About two-thirds agreed that they had increased their emphasis on higher-level learning in the classroom, project-based learning, or interactions with parents and students as a result of participating in the Laptop program. All teachers agreed that being in the Laptop program was personally beneficial, and that they would like to participate in the program again next year.

All the teachers agreed that participation in the Laptop program increased students' writing and reading skills. The majority of teachers perceived increases to occur in students' interest in learning, ability to work with other students, and performance/grades. The teachers also felt that use of the laptop had resulted in students having greater research skills, improved

writing skills, greater interest in school, and greater self-confidence. The difficulties cited were all related to the technology itself (e.g., power, weight, drives, server, and printers).

Teacher Interviews. The three Laptop teachers felt that the most effective aspects of the program were improved ability of students to use the computer and to conduct internet-based research. There was general agreement that the two most difficult aspects of the program were monitoring use of the internet and technical difficulties. The CE teachers indicated a desire for more computers to decrease the student-to-computer ratio. Like the Laptop teachers, the CE teachers felt that the most difficult aspects were management of student internet use and equipment failures. However, unlike the Laptop teachers, they also experienced difficulty due to student unfamiliarity with computer use.

PARENT REACTIONS

Parent Survey. More than half of Laptop parents and CE parents attributed their child's program with improvements in their child's interest in school, involvement in projects, and research skills. Additionally, 57% of the Laptop parents (versus 20% for CE) believed that improvement in writing skills was attributable to computer usage, and 49% (versus 27% for CE) believed that improvement in achievement occurred.

Both groups appreciated that their children were learning technology skills and general learning skills. As for negative aspects, about one-fourth of the Laptop parents indicated that the computer was hard for their child to carry. Approximately the same number of Laptop parents felt that computer breakage and dealing with the selected service agent was the most difficult aspect.

DISCUSSION

IS TEACHING DIFFERENT IN A LAPTOP CLASSROOM?

In contrast to the Year 1 evaluation, the present study revealed relatively few differences in teaching methods between Laptop and CE classes. Objectively, the most obvious explanation of the discrepancies is that the present sample of Laptop classes tended to use student-centered teaching approaches less frequently than did the Year 1 group. While the present (Year 2) Laptop classes were certainly busy and active places compared to typical classrooms that we have observed (Ross, Smith, Alberg, & Lowther, 2000) perhaps the teachers were less influenced by a “Hawthorne-type” effect than in Year 1, and thus were less likely to demonstrate “model” lessons. Some may have felt more confident about intermixing traditional practices to ensure that state content standards were being addressed. CE classrooms, however, were generally comparable to the Control classrooms of the first year.

Consistent across both years of the study was the Laptop students’ more frequent usage of the computer as a learning tool. Specifically, such applications were observed in 66% of the visits to Laptop classes compared to only 17% of the CE classes, a highly significant difference. The SCU findings further revealed greater use of word-processing and CD referencing in the Laptop classes. In view of CE classes also having NTeQ-trained teachers and enhanced technology resources, they still indicate positive impacts of the Laptop program for infusing technology use into teaching practices.

DO STUDENTS BEHAVE DIFFERENTLY IN A LAPTOP CLASSROOM?

In the present study, the Laptop and CE students behaved fairly comparably, except that Laptop students tended to use computers more frequently, extensively, and independently.

DO STUDENTS ACHIEVE DIFFERENTLY IN A LAPTOP CLASSROOM?

In the present study, the writing assessment included both the 6th and 7th grades. Results showed substantial advantages for Laptop over CE students. Six of the eight effect sizes (4 components x 2 grades) exceeded $+ .80$, while the mean differences in many cases approximated or exceeded a full rubric point. Clearly, the Laptop students were demonstrating superior writing skills.

Although the SOM data did not reveal significant differences in sustained writing activities in Laptop vs. CE classrooms, SCU data did reveal significantly greater use of word processing by the Laptop students. In their survey responses, nearly 75% of the Laptop students and 100% of the teachers felt that use of the laptop had improved their writing. Fewer, but still a majority (57%) of the Laptop parents also concurred that the program engendered improved writing skills. More than half of the Laptop students indicated that the best thing about having the computer was that it made school work, or primarily writing, easier.

The Laptop program's positive impact on problem-solving may have been influenced by students' engagement in research activities, as evidenced in teacher and student survey responses. Student Survey responses revealed greater confidence by Laptop and CE students in using basic software applications. Engagement in research activities was often perceived as one of the best aspects of the Laptop program.

Conceivably, engaging in more problem-solving activities and having greater access to application software for solving problems increased Laptop students' range for planning and conceptualizing how a new, complex problem could be approached and systematically solved. Given the quasi-experimental nature of the research design, using pre-established groups,

these interpretations can only be speculative at this point. Further research is needed to demonstrate similar findings with other student groups.

CONCLUSIONS

In the Year 2 evaluation of the Laptop Program, the results are supportive of beneficial impacts of the Laptop program on students, teachers, and parents. As in the Year 1 study, all three groups believed that the program was positively changing teaching and learning both at school and at home. Although the results were less striking this year, the reasons seem largely due to (a) CE teachers being more oriented and trained to use computers than were the Year 1 “control” teachers, and (b) the scale-up of the Laptop program to more teachers and classes. Still, there was no question that the Laptop students were far superior to CE students in their computers skills and usage of technology for learning.

Even though pre-formed groups were used in the present study, the positive results from the writing and problem-solving assessments are nonetheless highly suggestive. Laptop students were doing more sustained writing in class and were demonstrating more skill in writing, making a causal connection highly likely. It is obvious that continual and immediate access to computers provides the Laptop students and their teachers with a very strong advantage. Similarly, Laptop students had greater opportunity to engage in open-ended learning tasks that emphasized problem solving, and to use a variety of software tools to increase the speed and depth of their work.

Given the above conclusion, we should note a possible concern that acquired greater saliency in this year’s results. First, it is noteworthy that having to carry the computer to and

from school was viewed by both Laptop students and their parents as the most significant negative aspect of the program. Yet, students and parents reported only a moderate amount of school-related computer use at home. Equipment problems (with extended waits for repair) seemed to be exacerbated by all of the transporting of computers. Second, there was noticeably increased dissatisfaction by students and parents with the exclusionary nature of the program. Those not selected for financial or other reasons would miss out on the benefits of technology-immersed classroom learning. Perhaps the finding of greatest importance from the past two years is that full access to computers in the classroom, whether or not there is access at home, is what drives curriculum and learning most substantively. Further study of stakeholder reactions, school policies, and resource constraints is suggested to determine whether reorientation of the Laptop concept to make classroom computer use available to all students might yield the highest overall satisfaction and results.

ANYTIME, ANYWHERE LEARNING

FINAL EVALUATION REPORT OF THE LAPTOP PROGRAM: YEAR 2

This report summarizes the results of an evaluation study of the Year 2 implementation of the Anytime, Anywhere Learning (Laptop Program) implemented in Walled Lake Consolidated Schools (WLCS). As in the Year 1 evaluation (Ross, Morrison, Lowther, & Plants, 2000), the overall purpose of this study was to determine the educational impact of providing 5th, 6th, and 7th grade students with access to laptop computers with regard to classroom learning activities, technology usage, and writing achievement.

The Laptop Program is based on the Anytime, Anywhere Learning (AAL) program (AAL, 2000), which has been in schools since 1996 and has impacted more than 100,000 students and teachers. The goal of the AAL program is to provide students the knowledge, skills and tools to learn anytime and anywhere. In the Year 1 evaluation, the findings showed that Laptop students were using computers more extensively and skillfully in their classrooms than were non-Laptop students. Importantly, usage of the computers was significantly more meaningfully integrated with curriculum in Laptop than in Control classrooms. Laptop students also significantly surpassed non-Laptop students in writing skills, an outcome considered attributable to the increased opportunities to practice writing via the computer.

The WLCS Laptop Program arranged to have laptop computers available for a monthly lease fee during the first year and purchase in the second year. The Laptop classrooms were equipped with wireless access to the internet and printers. The program provided Year 1 students and parents the opportunity to receive training on basic computer skills. Year 2 students and parents received a software tutorial for learning basic computer skills.

Year 1 of the Laptop program began with 26 teachers who taught grades 5 and 6. These teachers received ten full days of professional development prior to the 1999-2000 academic year and six one-half day sessions during the year. For Year 2, the 5th and 6th grade students took their laptops with them to the 6th and 7th grades and 8 new 5th grade laptop classrooms were added. Teachers new to the program received after-school and summer training that was equivalent to a 3-hour graduate level course. The training was based on the iNtegrating Technology for inQuiry (NteQ) model (Morrison & Lowther, 2002), which provides teachers a framework to develop problem-based lessons that utilize real-world resources, student collaboration, and the use of computer tools to reach solutions. The lessons are typically structured around projects which engage the students in critically examining community and global issues, while strengthening student research and writing skills.

RESEARCH QUESTIONS

The Year 2 evaluation of the Laptop Program was structured around three primary research questions that focused on classroom practices, student behaviors, and student achievement. Also of interest was the reaction and support of teachers and parents involved with the Laptop Program. The detailed research questions are listed below:

- Is teaching different in a Laptop classroom? To answer this question, observers examined classroom practices to determine if instructional practices in Laptop classrooms were different from those in non-Laptop classes. For example, were classrooms lecture-based and/or project-based: Were the classrooms academically focused and were students engaged? Did teacher questions call for students to construct responses or simply recall factual information?
- Do students behave differently in a Laptop classroom? By observing and talking to students, observers gauged the level of interest in learning, student attitude toward using technology, and the degree to which students take initiative for their learning as opposed to being dependent on the teacher for constant direction.
- Do students achieve differently in a Laptop classroom? In the present Year 2 study, we examined two measures of achievement—writing skills and problem-solving. With regard to writing, trained observers assessed writing samples from Laptop and Computer-Extended (non-Laptop) classrooms for both content and quality, observed whether writing in the classroom was sustained or short-term question and answer, and whether technology was used as a tool to increase the quality of work or simply for computer-assisted instruction. With regard to problem-solving, trained raters judged the degree to which Laptop and Computer-Extended students demonstrated the ability to understand a new problem, devise and carry out solution strategies, and present findings. The analyses also examined learner reliance on technology and cooperative learning strategies as components of their proposed problem-solving strategies.

EVALUATION DESIGN AND MEASURES

The evaluation period extended from September 1, 2000 through June 15, 2001. The evaluation design was based on both quantitative and qualitative data collected from students, teachers, and parents involved with the Laptop Program and students and teachers in Computer-Extended classrooms in eight schools (four elementary and four middle) within WLCS. Comparative analyses were completed for teaching activities and learning outcomes and descriptive analyses were completed for student, teacher, and parent reactions to both the Laptop Program and Computer-Extended (CE) classes.

PARTICIPANTS

Year 2 of the Laptop program involved 40 classrooms distributed across three grade levels: 8 fifth grade, 15 sixth grade, and 16 seventh grade. The participant pool from which data for the Laptop evaluation were collected included from these grades all teachers, students, and parents involved with the Laptop Program and randomly selected 5th, 6th, and 7th grade Computer-Extended teachers, students, and parents from schools with Laptop Programs. The CE comparison group classrooms had from 1 to 5+ computers available for student use as compared to Laptop classrooms which had one laptop computer per student. The comparative component of the study involved classroom observations, a writing assessment, problem-solving test, student survey, and parent survey. The numbers of participants by evaluation measure can be seen in Table 1.

Table 1

Evaluation Measure by Number of Laptop and Computer-Extended (CE) Participants

Evaluation Measure	Total Number	Number by Participant Group
School Observation Measure	55	5th Grade 08 Laptop classes 10 CE classes 6th Grade 17 Laptop 06 CE 7th Grade 07 Laptop 07 CE
Survey of Computer Use	55	5th Grade 08 Laptop classes 10 CE classes 6th Grade 17 Laptop 06 CE 7th Grade 07 Laptop 07 CE
Writing Test	118	6th Grade 29 Laptop students 29 CE students 7th Grade 30 Laptop 30 CE
Problem-Solving Test	111	52 6 th Grade Laptop students 59 6 th Grade CE students
Student Survey	391	257 6 th and 7 th Grade Laptop students 134 6 th and 7 th Grade CE students
Student Focus Group	71	5th Grade 06 Laptop classes 05 CE classes 6th Grade 05 Laptop 06 CE 7th Grade 27 Laptop 22 CE
Teacher Survey	08	08 Laptop teachers
Teacher Interview	06	03 Laptop teachers (1 @ 5 th , 6 th , & 7 th) 03 CE Teachers (1 @ 5 th , 6 th , & 7 th)
Parent Survey	96	66 Laptop parents 30 CE parents

MEASURES

The data set for the evaluation included classroom observations, student writing test scores, student surveys and focus groups, teacher surveys and interviews, and parent surveys. Descriptions of each measure and its administration procedure is given below.

CLASSROOM OBSERVATIONS

Classroom visits were conducted by trained and unbiased observers to collect frequency data regarding observed instructional practices. Two separate observations measures were used to collect data: The *School Observation Measure (SOM[®])* and the *Survey of Computer Use (SCU[®])*. The *SCU[®]* was used as an extension to the *SOM[®]* to provide more detailed observation data regarding student use of technology.

SOM[®] Structured observations have been conducted by researchers across the United States for several years using the *Classroom Observation Measure (COM[®])*, developed and validated by researchers at the Center for Research in Educational Policy (Ross et al., 1991). Overall observation items from *COM[®]* were modified to create the *SOM[®]* (Appendix A) which was purposely designed to provide a more practical instrument for formative evaluation in that it allows for a greater number of classrooms to be visited and requires less extensive training of observers than the *COM[®]*.

To ensure the reliability of data, observers receive a manual providing definitions of terms, examples and explanations of target strategies, and a description of procedures for completing the instrument. After receiving instruction in a group session, each observer participates in sufficient practice exercises to ensure that his/her data are comparable with those of experienced observers. In a reliability study (Lewis, Ross, & Alberg, 1999), pairs of trained observers selected the identical overall response on the five-category rubric on 67%

of the items and were within one category on 95% of the items. Further results establishing the reliability and validity of *SOM*® are provided in the report (see also Ross, Smith, Alberg, & Lowther, 2000).

The standard *SOM*® procedure involves observers visiting 10-12 randomly selected classrooms, for 15 minutes each, during a three-hour visitation period. The observer examines classroom events and activities descriptively, not judgmentally. Notes are taken relative to the use or nonuse of 24 instructional strategies, such as cooperative learning, direct instruction, and technology. At the conclusion of the three-hour visit, the observer summarizes the frequency with which each of the strategies was observed across all classes in general on the *SOM*® Data Summary form. The frequency is recorded via a 5-point rubric that ranges from (0) Not Observed to (4) Extensively.

For the Laptop program evaluation, the focus was the program within the school (Laptop vs. CE) rather than the whole school. Accordingly, Laptop and CE teachers were the basic observation samples. Because individual teachers are likely to be more consistent in their teaching orientations than are multiple teachers in a school, one *SOM*® was based on 60 continuous minutes of observation, divided into about 4 (rather than 10-12) 15-minute segments. These 4 observation periods were then summarized on one *SOM*® Data Summary form. Specifically, a total of 55 *SOM*® observation periods were conducted in 5 schools during the Spring 2001 academic year. Of the 55 observation periods, approximately 60% (32) were conducted in Laptop classrooms and approximately 40% (23) in CE classrooms to provide control data.

SCU® A companion instrument to *SOM*® in this study was the Survey of Computer Use (*SCU*®) (Lowther, Ross, Clark, & Adcock, 1999). As with *SOM*® observations, a total of

55 *SCU*® observations were conducted. Each *SCU*® reflects 60 minutes of observation that was divided into about four, 15-minute segments which were summarized on one *SCU*® Data Summary form (Appendix B).

The *SCU*® items were compiled through examination of research, existing instruments, focus groups of K-12 teachers and administrators, researchers, college faculty, and a series of formative evaluation strategies. The reliability of *SCU*® was determined in a study involving pairs of trained observers conducting *SCU*® observations in 42 targeted visits to classrooms that were scheduled to have students using technology. Results from the study revealed that overall, the paired observers selected the identical SCU response on 86% of the items with all other responses only being one rating apart. When looking at subcategories of the *SCU*®, the percentage of times that paired observers selected the same response was as follows:

computer configuration - 83%; students per computer - 95%; student computer skills - 70%; types of computer activities/tools - 92%; subject areas of computer activities - 88%, and overall rubric rating meaningfulness of computer activities - 88% (Lowther & Ross, 1999).

As with the *SOM*®, reliability of data is ensured by providing *SCU*® Training Manuals to each observer. The manual provides item-by-item descriptions, definitions, screen shots of computer applications, and examples of what might be observed. All observers also participate in sufficient hands-on practice to ensure that his/her data are comparable with those of experienced observers.

The *SCU*® was designed to capture exclusively *student* access to, ability, and use of computers rather than teacher use of technology. Therefore, four primary types data are recorded: (a) computer capacity and currency, (b) configuration, (c) student computer ability and (d) student activities while using computers. Computer capacity and currency is defined

as the age and type of computers available for student use and whether or not internet access is available. Configuration data refers to the number of students working at each computer (e.g., alone, in pairs, in small groups). Student computer ability is assessed by recording the number of students who were computer literate (e.g., easily used software features/menus, saved or printed documents), and the number of students who easily used the keyboard to enter text or numerical information.

The next section of the *SCU*[®] focuses on student use of computers with regard to: the types of activities, subject areas of activities, and software being used. The computer activities are divided into three categories based on the type of software being used: production tools, internet/research tools, and educational software. Within each category, primary types of software are identified. For example, under Production Tools, the software includes: word processing, databases, spreadsheets, draw/paint/graphics, presentation (e.g., PowerPoint[™]), authoring (e.g., HyperStudio[™]), concept mapping (e.g., Inspiration), and planning (MS Project[™]). For the internet/research tools, three types of software are included: internet browser, CD reference materials, and communications (e.g., email, lists, chat rooms). The Educational Software also has three types of software: drill/practice/tutorial, problem-solving (e.g., Oregon Trail[™]) and process tools (e.g., Author's Toolkit[™]). With this type of recording system, several activities could be noted during the observation of one student working on a computer. For example, if a student gathered data from the internet, created a graph from the data, then imported the graph into a PowerPoint presentation, the observer would record three types of software tools as being observed: internet browser, spreadsheet, and presentation. The computer activities and software being used are summarized and recorded using a five-point rubric that ranges from

(0) Not Observed to (4) Extensively Observed. This section ends by identifying the subject area of each computer activity. The categories include language arts, mathematics, science, social studies, and other.

The final section of the *SCU*® is an “Overall Rubric” designed to assess the degree to which activities reflect “meaningful use” of computers *as a tool* to enhance learning. The rubric has four levels: 4 - Very meaningful, 3 – Meaningful, 2 – Somewhat meaningful, 1 – Low level use of computers. As with the previous items, a five-point rubric (0 = Not Observed; 4 = Extensively Observed) is used to rate each of the four rubric levels, (e.g., “How frequently were very meaningful computer activities observed?”)

STUDENT ACHIEVEMENT

Writing Test. As a means of determining the impact of the Laptop Program on student performance, the WLCS’s *Writing Scoring Guide* was used to assess prompted writing samples from Laptop and CE students. The District’s assessment examines four dimensions of writing: Ideas and Content, Organization, Style, and Conventions. The rubric employed categorizes the writing sample into one of four levels on each dimension: Mature (4), Capable (3), Developing (2), Emerging (1). A copy of the rubric criteria for each dimension x level category is provided in Appendix C.

All WLCS students in grades 3 through 8 complete the writing test at the end of the academic year. The assessment involves students being asked to write a letter of introduction to their “new” teacher for next year. For this study, 59 Laptop (29 - 6th; 30 - 7th) and 59 CE (29 - 6th; 30 - 7th) writing samples were randomly selected from those taken for the district test for comparative analysis. An experienced reviewer used the district’s four-point rubric to

conduct a blind assessment of the writing samples for each of the four dimensions, yielding four scores per student.

PROBLEM-SOLVING TASK

To assess the ability of students to comprehend problems and formulate solutions, a problem-solving task was devised for this study. The task posed the following problem situation:

POP CANS AT THE PARK

There are several soda pop machines at the city parks. When you buy a can of soda pop, it costs 10 cents extra. This 10 cents is for a deposit that you get when you take the can back for recycling. The park managers have found a large number of cans in the parks' trashcans. The City Parks Commission wants to have more people recycle their cans. They have asked you to help them study this problem *all summer*.

Is there a way to help people recycle their soda cans?

Please tell us *how* you will solve this problem. Describe with details what you would do. Describe the materials and resources you will use. Would you work with others? If so, describe how you would work with them.

Tell us how you will determine:

- Which park has the largest number of cans in the trash?
- How much money does the vending company keep from cans that are never turned in for a deposit?
- What are the benefits of recycling - does it really make a difference in saving natural resources?
- What might you do to encourage people to recycle the cans rather than putting them in the trash? (List as many ideas as you can.)
- How could you determine if increasing the deposit amount would increase the return of cans to collect the deposit?
- How would you present the results to the Parks Commission?

Laptop and CE teachers received written instructions for administering the problem-solving task. These instructions indicated that students had 45 minutes to complete the task and should take the test via computer. Teachers were asked to read a statement to students that instructed them to not include their name or any other identifying marks on their work

and that participation was voluntary. The problem-solving task and administration procedures can be found in Appendix D.

Random samples of 52 Laptop and 59 CE students in the 6th grade were administered the task. A trained reviewer judged the students' responses on a rubric composed of 7 Components x 3 Performance Levels (see Appendix E). Components consisted of: "Understands problem," "Identifies what is known about problem," "Identifies what needs to be known to solve the problem," "Determines how the data need to be manipulated to solve the problem," "Describes use of technology," "Describes how to present findings, and Collaborative learning."

STUDENT REACTIONS

To increase understanding of the implementation processes and outcomes of the Laptop Program, a survey was administered and focus groups were conducted with randomly selected students participating in the Laptop Program and CE classrooms. Details of the survey and focus groups are below.

Student Survey The 35-item Laptop Student Survey included multiple choice, Likert-type items and open-ended questions (Table 12). The survey begins by asking students how having the laptop has impacted them personally. These items addressed the student's writing ability, interest and improvement in school, and if the laptop made school work easier. The next section explored if students worked with other students while using the laptop and asked students to identify the subject areas covered in laptop lessons. The students then were asked to describe how often they used the laptop at home, what laptop activities they did at home, and if other family members used the computer. The last questions in this section inquired about internet access in the home. If internet access was

available, students were asked to identify if and how it was used. In Section 4, students were asked to rate how well they used 11 different types of computer software. The rating scale ranged from “Not at all” to “Very Well.” The final section, students were provided space to enter responses regarding the best and worst aspects of having a laptop, how the laptop program should be changed, and any other comments. The Laptop student survey was administered online during class time to 257 Laptop students.

The CE Student Survey was designed to be identical in length and context to the Laptop version, except that “Laptop” was replaced by the more generic term, “Computer.” The CE survey was also administered online, to 134 students.

Student Focus Group The Student Focus Group questions were targeted toward four major areas: “Overall Impressions of the Laptop Program,” “Classroom Level Changes,” “Student Results,” and “Parent Support” (Appendix F). Questions from the first section asked students to briefly describe what it was like to have the laptop. This was followed by asking them about the best and most difficult parts of having the laptop. The questions then changed focus to address how the laptops had changed what happened in the classroom. These items asked students if they had more projects this year, if the assignments were more involved, if their school work required more research and writing, and if authentic assessment tools such as portfolios or rubrics were used. This section was followed by asking students if they thought they were better students and if their relationships with other students or the teacher had changed as a result of having the laptop. Lastly, students were asked about parental support for the program, involvement with school activities, and whether or not the laptop had an impact on other family members. Six focus groups of randomly selected students/classes were conducted by researchers from Wayne State University. Distribution of students across

the groups was as follows: 5th grade – 6 Laptop, 5 CE; 6th grade – 5 Laptop, 6 CE; 7th grade – 27 Laptop (one class), 22 CE (one class).

TEACHER REACTIONS

All teachers participating in the Laptop Study were asked to complete a survey and a random sample was selected to participate in a Teacher Focus Group. Instruments for the survey and focus group are described below.

Teacher Survey The teacher survey was comprised of 34 items (Table 16). All items except for two demographic questions of the items used a Likert-type response method. The items were divided into three categories: “Personal Impact,” “Student Impact,” and “Student Use.” The Personal Impact items asked if the Laptop Program had increased their computer skills, their ability to design integration and project-based lessons, and/or communications with students and parents. The Student Impact items asked teachers their impressions about the Laptop Program’s impact on students’ interest in learning, grades, writing skills, research skills, or ability to work with others. The section on Student Use focused on student grouping during computer use and subject areas and the types of software used in laptop lessons. The CE Teacher Survey was essentially identical to the Laptop version except that the generic term “computers” replaced “laptop.”

Teacher Interview The Teacher Interview questions were grouped into five areas (Appendix G). Four of the areas were identical to Student Focus Group items: Overall Impressions of the Laptop Program, Classroom Level Changes, Student Results, and Parent Support. The fifth item was Impact on Teachers.

Overall impressions covered the quality of this year’s implementation, benefits, and difficulties of the program. For Classroom Level Changes, teachers were asked about project-

based and cooperative learning, the research and writing skills of students, and the use of authentic assessment. Student Results not only focused on achievement, but also student relationships with other students and the teacher, and student motivation/enthusiasm. The teachers were asked how the program had impacted them personally and their relationship with other teachers. The final section covered the impact of the Laptop Program on parent-teacher/school relationships and parental support.

The teacher interview participants were randomly selected from the pool of 5th, 6th, and 7th grade Laptop and CE teachers resulting in six teachers being interviewed (one teacher per grade level per group). The interviews were conducted by researchers from Wayne State University.

PARENT REACTIONS

The Laptop Program requires strong parental support in that parents must agree to pay monthly lease fees or purchase the laptop, and assume responsibility, with their child, for the laptop. Therefore, input from parents whose children are participating in the Laptop Program as compared to non-laptop parents is critical to understanding the impact of implementation.

Parent Survey Laptop and CE students who completed the student surveys were given Parent Survey Information Sheets to take home to their parents. The information sheet asked parents to complete the surveys online or request a paper-based copy. A total of 134 Laptop parents and 30 CE parents completed the survey for an overall return rate of 25%. Eighty-six parents completed the survey online, while 10 chose a paper-based format.

The purpose of the parent survey was to determine how having the laptop computer had impacted the student involved in the program and other members of the family (Table 17).

The parents were asked whether or not the family owned other computers and if internet access was available. For the families that had internet access, four items inquired about how the online resources were used. The next section asked for parent perceptions on how much the laptop had changed their son or daughter's interest, achievement, writing and research skills, involvement in projects, and ability to work with other students. Parents were then asked to reply to questions about whether or not the laptop had changed the respondent's, another adult's, or siblings' involvement with others in the family, usage of the computer, etc. The final section of the survey had opened-ended items that asked parents to describe the best aspect of the laptop program, the worst aspect of the program, how the program should be changed, and for any other comments. The CE version was similar but dealt with computers more generally, such as referring to "computers in the classroom" or "home computer" instead of "laptop."

RESULTS

SCHOOL OBSERVATION MEASURE[®] (SOM[®])

As indicated in the description of *SOM[®]*, the observation procedure focused on 24 instructional strategies using a five-point rubric (0 = Not Observed, 1 = Rarely, 2 = Occasionally, 3 = Frequently, and 4 = Extensively). Two additional items use a three-point scale (1 = Low, 2 = Moderate, 3 = High) to rate the degree to which academically-focused class time and student attention/interest/engagement are evidenced. Each observation lasted one hour. At the end of each session, the observer completed the final rubrics and ratings. The total number of observations completed was 32 for the Laptop teachers and 23 for the CE teachers.

Observed vs. Not Observed. In an initial analysis, we collapsed the rubric categories 2-4 into one category to yield a two-category scheme reflecting the percentage of visits in which a strategy was either observed or not observed. A summary of the overall findings (grades 5, 6, and 7 combined) for Laptop and CE schools, listed by percentage of times observed, is presented in Table 2. Asterisks that appear on the table adjacent to the strategy label indicate a statistically significant effect derived from a two-way chi-square analysis in which the factors were Observed (Yes or No) and Treatment (Laptop vs. CE).

Table 2

Proportion of times an event was observed (1-4) versus not observed (0) for Laptop (Grades 5, 6, and 7 combined)

Strategies	Laptop (n=32)		Computer Extended (n=23)	
	Observed	Not Observed	Observed	Not Observed
Direct instruction	68.8	31.3	60.9	39.1
Team teaching	0.0	100.0	4.3	95.7
Cooperative/collaborative learning	21.9	78.1	17.4	82.6
Individual tutoring	3.1	96.9	8.7	91.3
Ability groups	0.0	100.0	0.0	100.0
Multi-age grouping	0.0	100.0	4.3	95.7
Work centers	0.0	100.0	8.7	91.3
Higher level instructional feedback	40.6	59.4	34.8	65.2
Integration of subject areas***	6.3	93.8	47.8	52.2
Project-based learning	22.6	77.4	30.4	69.6
Use of higher-level questioning	50.0	50.0	52.2	47.8
Teacher as a coach/facilitator	56.3	43.8	52.2	47.8
Parent/community involvement	0.0	100.0	4.3	95.7
Independent seatwork	40.6	59.4	60.9	39.1
Experiential, hands on learning	15.6	84.4	17.4	82.6
Systematic individual instruction	3.1	96.9	8.7	91.3
Sustained writing/composition	34.4	65.6	39.1	60.9
Sustained reading	12.5	87.5	26.1	73.9
Independent inquiry/research	37.5	62.5	21.7	78.3
Student discussion	21.9	78.1	26.1	73.9
Computer for instructional delivery	12.5	87.5	4.3	95.7
Technology as a learning tool***	65.6	34.4	17.4	82.6
Performance assessment	9.4	90.6	26.1	73.9
Student self-assessment	15.6	84.4	13.0	87.0

* $p < .05$, ** $p < .01$, *** $p < .001$

As can be seen in Table 2, there were two significant differences: Integration of subject areas was *less* ($p < .001$) frequently seen in Laptop (6.3%) than in CE (47.8%) classes. On the other hand, technology as a learning tool was *more* ($p < .001$) frequently seen in Laptop (65.6%) than in CE (17.4%) classes. Separate analyses by grade yielded essentially the same patterns and significant effects (see Tables H.1, H.2, and H.3 in Appendix K). These analyses show much more similarity between the Laptop and CE classes than was found in the Year 1 comparison between Laptop and Computer-Extended classes.

Full rubric. Tables 3 and 4 extend the results for all grades combined to all five rubric categories and the two summary items for the Laptop and CE classrooms, respectively. For Laptop, strategies viewed occasionally or more (frequently or extensively) in at least 30% of the classrooms include direct instruction (44% total), higher-level questioning (38%), teacher acting as coach or facilitator (44%), independent seatwork (41%), sustained writing (31%), and technology as learning tool (59%). For computer-extended classrooms, the strategies viewed occasionally or more in at least 30% of the visits included direct instruction (57%), higher-level instructional feedback (35%), integration of subject areas (35%), higher-level questioning (52%), teacher acting as coach or facilitator (35%), independent seatwork (52%), and sustained writing (39%). At the other extreme are strategies never or rarely observed. Those in Laptop classes reaching 95% or higher for these two lowest categories combined were team teaching, individual tutoring, ability grouping, multi-age groups, work centers, integration of subject areas, parent/community involvement, and systematic individual instruction. Those never or rarely observed in CE classes were team teaching, individual tutoring, ability grouping, multi-age groups, parent/community involvement, and computer for

instructional delivery. On the two final summary items, it should also be noted that in Laptop classes (Table 3), academically-focused class time was rated as high in 72% of the visits, while level of student interest/engagement was rated as high in 62%. In CE classes (Table 4), by comparison, these ratings were 69% and 43%, respectively.

Table 3

SOM Descriptive Data on the Full Rubric for Laptop Classrooms (All Grades Combined)

The extent to which each of the following was used or present in the classroom.	Percent None	Percent Rarely	Percent Occasionally	Percent Frequently	Percent Extensively
<i>Instructional Orientation</i>					
Direct instruction (lecture)	31.3%	25.0%	18.8%	15.6%	9.4%
Team teaching	100.0%	0.0%	0.0%	0.0%	0.0%
Cooperative/collaborative learning	78.1%	6.3%	9.4%	6.3%	0.0%
Individual tutoring (teacher, peer, aide, adult volunteer)	96.9%	3.1%	0.0%	0.0%	0.0%
<i>Classroom Organization</i>					
Ability groups	100.0%	0.0%	0.0%	0.0%	0.0%
Multi-age grouping	100.0%	0.0%	0.0%	0.0%	0.0%
Work centers (for individuals or groups)	100.0%	0.0%	0.0%	0.0%	0.0%
<i>Instructional Strategies</i>					
Higher level instructional feedback (written or verbal) to enhance student learning	59.4%	15.6%	12.5%	6.3%	6.3%
Integration of subject areas (interdisciplinary/thematic units)	93.8%	0.0%	0.0%	3.1%	3.1%
Project-based learning	77.4%	0.0%	3.2%	3.2%	16.1%
Use of higher-level questioning strategies	50.0%	12.5%	9.4%	21.9%	6.3%
Teacher acting as a coach/facilitator	43.8%	12.5%	12.5%	18.8%	12.5%
Parent/community involvement in learning activities	100.0%	0.0%	0.0%	0.0%	0.0%
<i>Student Activities</i>					
Independent seatwork (self-paced worksheets, individual assignments)	59.4%	0.0%	6.3%	12.5%	21.9%
Experiential, hands-on learning	84.4%	3.1%	0.0%	3.1%	9.4%
Systematic individual instruction (differential assignments geared to individual needs)	96.9%	3.1%	0.0%	0.0%	0.0%
Sustained writing/composition (self-selected or teacher-generated topics)	65.6%	3.1%	6.3%	15.6%	9.4%
Sustained reading	87.5%	3.1%	0.0%	6.3%	3.1%
Independent inquiry/research on the part of students	62.5%	9.4%	6.3%	9.4%	12.5%
Student discussion	78.1%	0.0%	3.1%	6.3%	12.5%
<i>Technology Use</i>					
Computer for instructional delivery (e.g. CAI, drill & practice)	87.5%	6.3%	3.1%	3.1%	0.0%
Technology as a learning tool or resource (e.g. internet research, spreadsheet or database creation, multi-media, CD ROM, Laser disk)	34.4%	6.3%	6.3%	15.6%	37.5%
<i>Assessment</i>					
Performance assessment strategies	90.6%	0.0%	0.0%	3.1%	6.3%
Student self-assessment (portfolios, individual record books)	84.4%	6.3%	3.1%	3.1%	3.1%
<i>Summary Items</i>			Low	Moderate	High
Academically focused class time			10.3%	17.2%	72.4%
Level of student attention/interest/engagement			10.3%	27.6%	62.1%

Table 4

*SOM Descriptive Data on the Full Rubric for Computer Extended Classrooms
(All Grades Combined)*

The extent to which each of the following was used or present in the classroom.	Percent None	Percent Rarely	Percent Occasionally	Percent Frequently	Percent Extensively
<i>Instructional Orientation</i>					
Direct instruction (lecture)	39.1%	4.3%	13.0%	26.1%	17.4%
Team teaching	95.7%	0.0%	4.3%	0.0%	0.0%
Cooperative/collaborative learning	82.6%	0.0%	8.7%	4.3%	4.3%
Individual tutoring (teacher, peer, aide, adult volunteer)	91.3%	4.3%	0.0%	4.3%	0.0%
<i>Classroom Organization</i>					
Ability groups	100.0%	0.0%	0.0%	0.0%	0.0%
Multi-age grouping	95.7%	0.0%	0.0%	0.0%	4.3%
Work centers (for individuals or groups)	91.3%	0.0%	0.0%	4.3%	4.3%
<i>Instructional Strategies</i>					
Higher level instructional feedback (written or verbal) to enhance student learning	65.2%	0.0%	4.3%	26.1%	4.3%
Integration of subject areas (interdisciplinary/thematic units)	52.2%	13.0%	13.0%	13.0%	8.7%
Project-based learning	69.6%	0.0%	4.3%	8.7%	17.4%
Use of higher-level questioning strategies	47.8%	0.0%	17.4%	26.1%	8.7%
Teacher acting as a coach/facilitator	47.8%	17.4%	8.7%	21.7%	4.3%
Parent/community involvement in learning activities	95.7%	4.3%	0.0%	0.0%	0.0%
<i>Student Activities</i>					
Independent seatwork (self-paced worksheets, individual assignments)	39.1%	8.7%	17.4%	21.7%	13.0%
Experiential, hands-on learning	82.6%	0.0%	4.3%	8.7%	4.3%
Systematic individual instruction (differential assignments geared to individual needs)	91.3%	0.0%	4.3%	4.3%	0.0%
Sustained writing/composition (self-selected or teacher-generated topics)	60.9%	0.0%	13.0%	21.7%	4.3%
Sustained reading	73.9%	4.3%	8.7%	4.3%	8.7%
Independent inquiry/research on the part of students	78.3%	0.0%	4.3%	4.3%	13.0%
Student discussion	73.9%	4.3%	8.7%	13.0%	0.0%
<i>Technology Use</i>					
Computer for instructional delivery (e.g. CAI, drill & practice)	95.7%	0.0%	0.0%	0.0%	4.3%
Technology as a learning tool or resource (e.g. internet research, spreadsheet or database creation, multi-media, CD ROM, Laser disk)	82.6%	0.0%	4.3%	4.3%	8.7%
<i>Assessment</i>					
Performance assessment strategies	73.9%	4.3%	8.7%	8.7%	4.3%
Student self-assessment (portfolios, individual record books)	87.0%	4.3%	4.3%	0.0%	4.3%
<i>Summary Items</i>			Low	Moderate	High
Academically focused class time			8.7%	21.7%	69.6%
Level of student attention/interest/engagement			17.4%	39.1%	43.5%

Table 5 lists significant results ($p = .018$, $ES = +1.25$) $< .05$) from t -tests comparing the means for Laptop and CE classes on each SOM[®] item in each grade. The table also shows the standard deviations, significance (probability) levels for the t -tests, and effect sizes. Effect sizes compliment significance tests by indicating the number of standard deviations by which the “experimental” or “program” group mean exceeds the control group mean. In the present analyses we computed effect sizes via Cohen’s d formula (Cohen, 1988), using the pooled standard deviation for the Laptop and CE groups in the denominator. Effect sizes in absolute value ranging from $+.40$ to $+.60$ are considered moderate in size and of educational importance; those exceeding $+1.00$ are considered to be strong in magnitude and of high importance. Note, however, that to be viewed seriously (i.e., as reliable), even a large effect size should be associated with a statistically significant difference.

In Grade 5, results strongly favored the Laptop classes on using technology as a learning tool ($ES = +1.25$) and on level of student attention/interest ($ES = +0.89$). The CE group, however, was favored on use of higher-level questioning ($ES = -1.08$) and integration of subject areas ($ES = -0.98$). Table 5 shows that significant differences occurred in Grade 6 on only one item: As in the fifth-grade, the sixth-grade Laptop classes made more extensive use than did CE classes of technology as a learning tool ($ES = +1.31$). None of the comparisons was significant in Grade 7.

Table 5

Summary of Items Showing Significant Differences Between Comparisons on the SOM by Grade

Grade 5						
Items Using Rating Scale A **	<u>Laptop</u>		<u>Computer Extended</u>		<i>t</i>	<i>ES</i>
	M	SD	M	SD		
Technology as a learning tool	1.88	1.89	0.20	0.63	2.41*	1.25
Use of higher-level questioning	0.38	0.52	1.60	1.43	-2.51*	-1.08
Integration of subject areas	0.00	0.00	0.70	0.95	-2.33*	-0.98
Level of student attention/interest	3.00	0.00	2.50	0.71	2.24*	0.89

*Sorted by Effect Size

Grade 6						
Technology as a learning tool	2.18	1.91	0.00	0.00	4.69**	1.31

**Rating Scale

0 = Not Observed

1 = Rarely Observed

2 = Occasionally Observed

3 = Frequently Observed

4 = Extensively Observed

* $p < .05$, ** $p < .01$, *** $p < .001$

Summary. In summary, the SOM data revealed relatively few differences in teaching methods between Laptop and CE classes. However, teachers of CE classes, like those of Laptop classes, were also trained in the NTeQ model and had fairly substantial access to computers for instructional purposes. Nonetheless, despite being exposed to generally comparable teaching methods, students in CE classes were given fewer opportunities than their Laptop counterparts to employ technology as a learning tool. The SCU data reported below explored these practices in greater depth.

SURVEY OF COMPUTER USE (SCU®)

Findings on the SCU® are summarized for all grades combined in Table 6. Although we examined the findings separately by grades, the sample sizes were too small to permit inferential analyses. Readers interested in the individual grade analyses are referred to Tables I.1, I.2, and I.3 in Appendix I.

Review and informal comparison of the grade-specific analyses shows reasonable comparability across grades for Computer Capacity and Currency, Extent of Computer Use, and Computer Configuration, and Internet/Research Tools Used by Students. With regard to Production Tools Used by Students, word-processing was more frequently used in the 5th and 7th grades than in the 6th grades by Laptop students, and in the 7th grade relative to the two lower grades by CE students. Regarding Subject Areas of Computer Activities, Laptop activities involving production tools were mainly prevalent in the social sciences in the 7th grade but in language arts in the 5th grade. Internet research tools were more concentrated in the social sciences in the 6th grade and in language arts in the 7th grade. Non-core areas (“other”) were the predominant application area for CE students in all grades, with some emphasis on social sciences for internet/research in 5th and 7th grades.

The results shown in Table 6 are for all grades combined. Comparisons between Laptop and CE classes were made using chi-square tests of independence. Findings indicate that Laptop classes, as would be expected, contained more computers than did Control classes. Specifically, 83% of “all” Laptop classes contained more than five computers compared to only 52% of CE classes ($p < .05$). Laptop and CE classes were fairly comparable in the condition and currency of the computers; however, Laptop classes had more computers ($p < .05$) with internet access than did CE classes (e.g., 93% All vs. 68% All, respectively).

Table 6

Survey of Computer Use Data Summary: Laptop vs. Computer-Extended for All Grades Combined

Computer Capacity and Currency		Percent Observed				
Group		None	Few	Some	Most	All
Laptop	Classrooms with 1 computer	100.0%	0.0%	0.0%	0.0%	0.0%
	Classrooms with 2 - 4 computers	90.3%	0.0%	0.0%	6.5%	3.2%
	Classrooms with 5 or more computers*	13.8%	3.4%	0.0%	0.0%	82.8%
	Computers that were outdated and limited in capacity	96.6%	3.4%	0.0%	0.0%	0.0%
	Computers that were aging but adequate	93.1%	0.0%	6.9%	0.0%	0.0%
	Computers that were up-to-date	6.9%	3.4%	0.0%	3.4%	86.2%
	Computers with internet access*	6.9%	0.0%	0.0%	0.0%	93.1%
Computer Extended	Classrooms with 1 computer	100.0%	0.0%	0.0%	0.0%	0.0%
	Classrooms with 2 - 4 computers	75.0%	4.2%	0.0%	0.0%	20.8%
	Classrooms with 5 or more computers	48.0%	0.0%	0.0%	0.0%	52.0%
	Computers that were outdated and limited in capacity	91.7%	0.0%	0.0%	0.0%	8.3%
	Computers that were aging but adequate	92.0%	0.0%	0.0%	0.0%	8.0%
	Computers that were up-to-date	32.0%	0.0%	0.0%	0.0%	68.0%
	Computers with internet access	32.0%	0.0%	0.0%	0.0%	68.0%
Extent of Computer Use		Percent Observed				
Group		None	Few	Some	Most	All
Laptop	Computers used by					
	nearly all (91-100%) students***	32.1%	0.0%	0.0%	3.6%	64.3%
	most (about 51-90%) students	92.3%	0.0%	0.0%	0.0%	7.7%
	some (about 10-50%) students	100.0%	0.0%	0.0%	0.0%	0.0%
	few (less than 10%) students	92.3%	0.0%	0.0%	0.0%	7.7%
Computer Extended	Computers used by					
	nearly all (91-100%) students	92.0%	0.0%	0.0%	0.0%	8.0%
	most (about 51-90%) students	100.0%	0.0%	0.0%	0.0%	0.0%
	some (about 10-50%) students	80.0%	0.0%	0.0%	4.0%	16.0%
	few (less than 10%) students	88.0%	0.0%	0.0%	0.0%	12.0%

Table 6

Survey of Computer Use Data Summary: Laptop vs. Computer-Extended for All Grades Combined

Computer Configuration		Percent Observed				
Group		Not Observed	Rarely	Occasionally	Frequently	Extensively
Laptop	Students worked alone at the computer*	25.0%	0.0%	14.3%	14.3%	46.4%
	Students worked in pairs at the computer	67.9%	10.7%	10.7%	10.7%	0.0%
	Students worked in small groups at the computer	75.0%	7.1%	14.3%	3.6%	0.0%
	Student were computer literate*	25.0%	0.0%	0.0%	7.1%	67.9%
	Students easily used the keyboard*	25.0%	0.0%	3.6%	7.1%	64.3%
Computer Extended	Students worked alone at the computer	64.0%	4.0%	8.0%	4.0%	20.0%
	Students worked in pairs at the computer	88.0%	8.0%	4.0%	0.0%	0.0%
	Students worked in small groups at the computer	96.0%	0.0%	40.0%	0.0%	0.0%
	Student were computer literate	64.0%	0.0%	4.0%	4.0%	28.0%
	Students easily used the keyboard	64.0%	0.0%	4.0%	8.0%	24.0%

Production Tools Used by Students		Percent Observed				
Group		Not Observed	Rarely	Occasionally	Frequently	Extensively
Laptop	Word Processing*	39.3%	3.6%	3.6%	7.1%	46.4%
	Database	96.4%	0.0%	0.0%	0.0%	3.6%
	Spreadsheet	96.4%	0.0%	0.0%	0.0%	3.6%
	Draw/Paint/Graphics	85.7%	3.6%	3.6%	7.1%	0.0%
	Presentation (e.g., MS PowerPoint)	89.3%	0.0%	3.6%	3.6%	3.6%
	Authoring (e.g., HyperStudio)	100.0%	0.0%	0.0%	0.0%	0.0%
	Concept Mapping(e.g., Inspiration)	100.0%	0.0%	0.0%	0.0%	0.0%
	Planning (e.g., MS Project)	100.0%	0.0%	0.0%	0.0%	0.0%
Computer Extended	Word Processing	76.0%	0.0%	8.0%	0.0%	16.0%
	Database	100.0%	0.0%	0.0%	0.0%	0.0%
	Spreadsheet	100.0%	0.0%	0.0%	0.0%	0.0%
	Draw/Paint/Graphics	92.0%	0.0%	4.0%	0.0%	4.0%
	Presentation (e.g., MS PowerPoint)	100.0%	0.0%	0.0%	0.0%	0.0%
	Authoring (e.g., HyperStudio)	100.0%	0.0%	0.0%	0.0%	0.0%
	Concept Mapping(e.g., Inspiration)	100.0%	0.0%	0.0%	0.0%	0.0%
	Planning (e.g., MS Project)	100.0%	0.0%	0.0%	0.0%	0.0%

Internet/Research Tools Used by Students		Percent Observed				
Group		Not Observed	Rarely	Occasionally	Frequently	Extensively
Laptop	Internet Browser (e.g., Netscape)	60.7%	3.6%	10.7%	7.1%	17.9%
	CD Reference (encyclopedias, etc.)	82.1%	3.6%	3.6%	3.6%	7.1%
	Communications	96.4%	3.6%	0.0%	0.0%	0.0%
Computer Extended	Internet Browser (e.g., Netscape)	76.0%	4.0%	12.0%	0.0%	8.0%
	CD Reference (encyclopedias, etc.)	100.0%	0.0%	0.0%	0.0%	0.0%
	Communications	96.0%	4.0%	0.0%	0.0%	0.0%

Table 6

Survey of Computer Use Data Summary: Laptop vs. Computer-Extended for All Grades Combined

Educational Software Used by Students		Percent Observed				
Group		Not Observed	Rarely	Occasionally	Frequently	Extensively
Laptop	Drill/Practice/Tutorial	100.0%	0.0%	0.0%	0.0%	0.0%
	Problem Solving (Oregon Trail, SimCity, etc.)	100.0%	0.0%	0.0%	0.0%	0.0%
	Process Tools (Geometer's Sketchpad, etc.)	100.0%	0.0%	0.0%	0.0%	0.0%
Computer	Drill/Practice/Tutorial	96.0%	0.0%	0.0%	4.0%	0.0%
Extended	Problem Solving (Oregon Trail, SimCity, etc.)	100.0%	0.0%	0.0%	0.0%	0.0%
	Process Tools (Geometer's Sketchpad, etc.)	100.0%	0.0%	0.0%	0.0%	0.0%
Subject Areas of Computer Activities		Percent Observed				
Group		Other	Language			
			Arts	Mathematics	Science	Social Science
Laptop	Production Tools***	5.6%	44.4%	5.6%	11.1%	33.3%
	Internet/Research Tools*	8.3%	33.3%	8.3%	8.3%	41.7%
	Educational Software	100.0%	0.0%	0.0%	0.0%	0.0%
Computer	Production Tools	100.0%	0.0%	0.0%	0.0%	0.0%
Extended	Internet/Research Tools	66.7%	8.3%	0.0%	0.0%	25.0%
	Educational Software	88.9%	0.0%	11.1%	0.0%	0.0%

* $p < .05$, ** $p < .01$, *** $p < .001$

With regard to Extent of Computer Use, computers were used by nearly all students significantly more frequently ($p < .001$) in Laptop than in CE classes. Given the 1:1 student-to-computer ratio in Laptop classes, students were more likely ($p < .05$) than CE students to work alone (61% vs. 24% frequently or extensively; see Computer Configuration in Table 6). Further, Laptop students were rated significantly higher than were CE students on computer literacy ($p < .05$) and keyboarding skills ($p < .05$). For example, students were evaluated as being computer literate frequently or extensively in 75% of the Laptop classes compared to only 32% of the CE classes. Conversely, computer literate students were not observed in 25% of the Laptop classes as opposed to 64% of the CE classes.

The Production Tools section of Table 6 reflects usage of word-processing as the primary production activity in both Laptop and CE classes. At least *occasional* use of word

processing was observed in 57% of the Laptop classes and in 24% of the CE classes, a significant contrast ($p < .05$). The production tools used the next most frequently were draw/paint/graphics tools (Laptop = 11% occasionally or more; CE = 8%) and presentation tools (Laptop = 11%, CE = 0%), although group differences were not significant. None of the Laptop or CE classes were observed using authoring, concept mapping, or planning tools.

As shown in the Internet/Research section, there was a directional tendency for Laptop classes to make relatively greater use of the internet browser (36% compared to CE's 20% for occasionally or more) and CD referencing (14% vs. 0%). Neither of these contrasts was significant. Further, no differences occurred in Educational Software Usage, due to virtually no observed use of any of the three types of software.

Table 7 summarizes statistically significant comparisons of observation means using t -tests for all grades combined. Most of these areas of difference have already been noted above in the non-parametric analyses of frequency data. The Table 7 findings basically show that Laptop compared to CE classes had a higher quantity of computers, more up-to-date computers, internet access, more frequent student use of computers, superior student computer skills, and more frequent use of word processing and CD referencing. Results on the overall rubric showed the Laptop classes ($M = 2.12$) to have a higher mean than the CE classes ($M = 1.78$), but the difference was not significant, $t(52) = 1.00$, $p = .327$, $ES = +0.31$.

Analyses conducted separately by grade showed comparable outcomes as above, except that in 6th grade only, Laptop students ($M = 2.50$) were rated significantly higher than CE students ($M = 1.00$) on the overall rubric concerning the meaningfulness of computer usage, $t(17) = 5.14$, $p < .001$, $ES = +1.43$.

Table 7

A Summary of Items Showing Significant Differences Between Laptop and Computer Extended Comparisons on the Survey of Computer Use (All Grades Combined)

Items	Scale*	Laptop		Computer Extended		t(52)	p	ES
		M	SD	M	SD			
Computer Capacity and Currency								
Classrooms with 5 or more computers	A	3.35	1.47	2.08	2.04	2.58	0.013	0.73
Computers that were up-to-date	A	3.59	1.15	2.72	1.90	2.05	0.045	0.56
Computers with internet access	A	3.72	1.03	2.72	1.9	2.36	0.024	0.67
Extent of Computer Use								
Computers used by 91-100% students	A	2.68	1.89	0.32	1.11	5.62	0.000	1.51
Computers used by 10-50% students	A	0.00	0.00	0.76	1.56	-2.43	0.023	-0.69
Computer Configuration								
Worked alone at the computer	B	2.57	1.67	1.12	1.67	3.17	0.003	0.87
Worked in pairs at the computer	B	0.64	1.06	0.06	0.47	2.18	0.036	0.58
Worked in small groups at the computer	B	0.46	0.88	0.08	0.40	2.08	0.044	0.55
Students were computer literate	B	2.93	1.74	1.32	1.84	3.27	0.002	0.90
Students easily used the keyboard	B	2.86	1.74	1.28	1.79	3.25	0.002	0.9
Production Tools Used by Students								
Word Processing	B	2.18	1.91	0.80	1.53	2.92	0.005	0.79
Internet/Research Tools Used by Students								
CD Reference	B	0.50	1.20	0.00	0.00	2.20	0.036	0.57
Subject Areas of Computer Activities								
Production Tools	C	2.22	1.48	0.00	0.00	6.38	0.000	1.79

*Rating Scales

<u>A</u>	<u>B</u>	<u>C</u>
0 = None	0 = Not Observed	0 = Other
1 = Few	1 = Rarely	1 = Language Arts
2 = Some	2 = Occasionally	2 = Mathematics
3 = Most	3 = Frequently	3 = Science
4 = All	4 = Extensively	4 = Social Studies

WRITING PERFORMANCE

Sixth- and seventh-grade students in Laptop and CE classes were asked to write, via word processing, a prompted essay. Sample sizes were 29 and 30 students per program in the two grades, respectively (total combined-grade n 's = 59 in each). The essays were then scored in the blind (regarding students' enrollment in Laptop vs. CE classes) on a rubric encompassing the four dimensions of Ideas and Content, Organization, Style, and Conventions. For each dimension, the essay was scored from 1 to 4, with 4 being the highest rating possible. Tables 8-10 summarize the findings for grade 6, grade 7, and the combined grades. Mean performance scores for Laptop and CE students were analyzed for each set of grade data via a one-way multivariate analysis of variance (MANOVA) with the four dimension scores serving as the dependent variables. Fifth grade Laptop ($n = 26$) students also completed a writing sample, but no comparison group was available. Thus, only descriptive data will be reported following the inferential results for the higher grades.

Table 8

A Summary of Items Showing Significant Differences Between Laptop and Non-Laptop (Grade 6)

Overall	Hypothesis							
	Hotellings T	F	df	Error df	Significance			
	0.401	8.87	4.00	53	0.000			

Component/Rating	Laptop		Non-laptop		F (1, 58)	p	ES
	Mean	SD	Mean	SD			
1. Ideas and Content	3.45	0.73	2.17	1.04	23.60	0.000	1.43
2. Organization	3.55	0.78	2.34	0.86	21.12	0.000	1.47
3. Style	3.20	0.82	2.34	0.77	10.78	0.000	1.10
4. Conventions	3.52	0.74	3.21	0.41	1.40	0.053	0.53

Table 9

A Summary of Item Showing Significant Differences Between Laptop and Non-Laptop (Grade 7)

Overall	Hypothesis							
	Hotellings T	F	df	Error df	Significance			
	0.2311	4.133	4.00	55.0	0.005			

Component/Rating	Laptop		Non-laptop		F(1, 60)	p	ES
	Mean	SD	Mean	SD			
1. Ideas and Content	2.73	0.91	2.00	0.69	12.36	0.001	0.90
2. Organization	2.60	1.00	1.87	0.73	10.47	0.002	0.83
3. Style	2.63	0.96	1.90	0.55	13.12	0.001	0.94
4. Conventions	3.43	0.50	3.13	0.51	5.28	0.025	0.59

Table 10

A Summary of Items Showing Significant Differences Between Laptop and Non-Laptop (Grades 6 and 7 Combined)

Overall	Hypothesis							
	Hotellings T	F	df	Error df	Significance			
	0.2592	9.888	4.00	113.0	0.000			

Component/Rating	Laptop		Non-laptop		F(1, 116)	p	ES
	Mean	SD	Mean	SD			
1. Ideas and Content	3.08	0.89	2.08	0.87	37.54	0.000	1.14
2. Organization	3.07	1.01	2.10	0.82	32.22	0.000	1.04
3. Style	2.92	0.93	2.12	0.69	27.58	0.000	0.98
4. Conventions	3.47	0.63	3.17	0.46	9.09	0.003	0.55

Sixth grade. The MANOVA yielded $F(4, 53) = 8.87, p < .001$, indicating a highly significant program effect. Consequently, univariate analysis of variance (ANOVA) was performed separately on each dimension. As shown in Table 8, three of the four tests (Ideas and Content, Organization, Style) were highly significant ($p < .001$). The fourth (Conventions) approached significance ($p = .053$). All reflected higher performance by Laptop than CE students. Effect sizes ranged from +0.53 to +1.47, with those for the three significant components all exceeding +1.00. Effects of this magnitude represent strong and educationally important impacts (see Cohen, 1988).

Seventh grade. The MANOVA yielded $F(4, 55) = 4.133, p < .005$, again indicating a highly significant program effect. Univariate analyses yielded significant differences favoring the Laptop students on each of the four dimensions (see Table 9). Effect sizes were moderate to strong in magnitude, ranging from +0.59 on Conventions to +0.94 on Style.

Combined grades. The MANOVA yielded $F(4, 113) = 9.888, p < .001$. As would be expected given the individual grade findings, the effects on all four components significantly favored the Laptop students (see Table 10). Effect sizes were high in magnitude, ranging from +0.55 (Conventions) to +1.14 (Ideas and Content).

Fifth grade. Descriptive results for the 26 Laptop 5th graders showed means of 3.50, 3.46, 2.96, and 3.23 on the four components, respectively. All of these means approximate or exceed a rubric rating of 3.00 (out of a possible 4.00), and thus indicate a fairly high average level of skills (see Appendix C for rubric descriptors).

PROBLEM-SOLVING PERFORMANCE

As described in the Method section, the problem-solving rubric consisted of seven components, each rated on a three-level scale (see Appendix E). Participants consisted of 111 sixth graders, 52 in the Laptop group and 59 in the CE group. A MANOVA comparing the means of the two groups on the seven components yielded a highly significant difference, $F(7, 103) = 3.378, p = .003$. Follow-up analyses (see Table 11) showed significant advantages for the Laptop group on all seven components. Effect sizes ranged from +0.38 to +0.76, the latter associated with “Understands Problem.” Another relatively large effect (ES = +0.72) was obtained on “Identifies What is Known About Problem.”

Table 11

Problem Solving

Overall	Hypothesis							
	Hotellings T	F	df	Error df	Significance			
	0.2295	3.3776	7.00	103	0.003			

Component/Rating	Laptop		Non-laptop		F(7,103)	p	ES
	Mean	SD	Mean	SD			
1. Understands Problem	2.56	0.67	1.98	0.84	15.59	0.000	0.76
2. Identifies what is known about the problem	2.29	0.78	1.71	0.85	13.76	0.000	0.72
3. Identifies what needs to be known to solve the problem	1.88	0.73	1.56	0.70	5.70	0.019	0.45
4. Determines how data should be manipulated to solve problem	1.67	0.76	1.41	0.62	4.13	0.044	0.38
5. Describes the use of technology	1.33	0.71	1.08	0.38	5.19	0.025	0.44

Student Survey

Laptop students. A total of 257 Laptop students completed the student survey. Of these, the majority (76%) were in sixth grade and about one-fifth (22%) were in seventh grade. Slightly over half (54%) were female. Table 12 summarizes the responses, which reflect both direct and indirect outcomes of the Laptop program. With regard to possible program impacts, the Laptop students were highly positive that their computer skills had increased (75% “a lot more”), and they could do internet research to find information (74.%). A strong majority (80%) were glad that they had a laptop computer and that they wanted to use a laptop computer again the following year (78%). Students were less committal that having a laptop increased their interest in learning (34% “a lot more”), in getting better grades (24%), or in working with other students (30%). The latter impact, though, while not viewed as strong, was still experienced as occurring at least “somewhat” by about 85% of the respondents.

Table 12

Summary of the Descriptive Statistics for Laptop Student Survey

	None	Somewhat	A lot more
My computer skills are better because I have a laptop.***	2.7%	22.7%	74.5%
Having a laptop has made me more interested in learning.***	14.7%	51.8%	33.5%
Because I have a laptop, I now want to get better grades.*	34.1%	41.7%	24.2%
My writing has improved because I use the laptop.***	26.4%	37.4%	36.2%
I can now do internet research to find information.	4.4%	21.5%	74.1%
The laptop makes it easier to work with other students.***	15.4%	54.2%	30.4%
I am very glad that I have the laptop computer.	4.0%	16.4%	79.6%
I want to use a laptop computer again next year.*	8.3%	14.2%	77.5%

	Never	Once a week	Several times a week	Almost everyday
How often do you use the laptop in the following ways while in the classroom?				
By yourself ***	5.6%	8.4%	39.8%	46.2%
With one other student ***	9.2%	48.6%	31.3%	10.8%
With a group or team ***	23.6%	44.0%	21.2%	11.2%
How often do you use the laptop in the following subjects?				
Language Arts ***	3.2%	8.0%	35.5%	53.4%
Mathematics ***	52.6%	33.3%	10.0%	4.0%
Science ***	7.2%	25.7%	45.8%	21.3%
Social Studies ***	4.4%	22.4%	41.2%	32.0%
About how often do you use the laptop for homework?***	8.0%	27.5%	45.8%	18.7%
How often do you use the laptop for things other than homework?***	8.5%	21.0%	39.9%	30.6%
How often do other family members use the laptop?***	69.4%	19.4%	7.9%	3.3%

	Yes	No
Do you have the internet at your home?	90.7%	9.3%

	Never	Once a week	Several times a week	Almost everyday
If yes, how often do you use the internet for schoolwork?***	12.1%	40.8%	35.8%	11.3%
If yes, how often do you use the internet for things other than schoolwork?*	9.5%	19.9%	32.0%	38.6%

Table 12

Summary of the Descriptive Statistics for Laptop Student Survey (continued)

	Not at all		OK		Very well
How well do you use the following software?					
Database (Access) **	16.3%	17.6%	35.5%	17.1%	13.5%
Drawing *	4.0%	9.7%	32.7%	21.8%	31.9%
Email **	4.0%	3.2%	10.9%	18.2%	63.6%
Games	5.3%	7.3%	12.2%	16.3%	58.9%
Fun Brain/Blackboard.com/Homework site***	20.5%	13.7%	25.7%	17.3%	22.9%
Internet searches**	2.0%	5.6%	15.7%	24.6%	52.0%
Power Point Presentation***	1.2%	1.6%	10.1%	21.1%	66.0%
Excel (or a Spreadsheet)***	2.0%	5.2%	23.0%	23.8%	46.0%
Microsoft Word (or a word processor)***	1.2%	1.2%	6.1%	13.5%	78.0%
Encarta or other encyclopedia on your laptop***	2.8%	2.8%	9.2%	18.5%	66.7%
A calendar or telephone book**	22.9%	17.7%	22.5%	17.7%	19.3%

* $p < .05$, ** $p < .01$, *** $p < .001$

Other survey questions dealt with the conditions under which computers were used in school and at home. Almost one half (46.2%) of the students generally worked with the laptop by themselves in the classroom every day. However, nearly all (91%) worked with one other student at least once a week, while about 76% worked with a group or team at least once a week. The most common subjects involved in laptop uses were language arts (53% “almost every day”) and social studies (32%). There was moderate use in science and more limited but still regular use in mathematics. Over half of the students (64%) reported using the laptop at least several times a week for completing homework, while even more (71%) reported regular uses for “other things.” About a third of the respondents (31%) reported use by other family members at least one time a week.

Nearly all (91%) students reported having access to the internet at home. There was moderate use of the laptop for internet access to complete homework (47% at least several

times a week), but more frequent use of the internet for “things other than schoolwork” (71% at least several times a week). An open-ended question asked students to describe how they use the internet at home. Responses indicated that online activities were focused in three areas, with schoolwork (37%) being mentioned slightly more than chat sessions (35%) or playing games (28%). The types of school-related activities included research for projects, checking class web pages for assignments, meeting in chat rooms to discuss projects, or asking the teacher or other students school-related questions. Most of the laptop responses listed homework first, then mentioned chat or games as something that was done if time allowed, as seen in the following comments to this item: “I use it for research on school work and any homework that I have to do, and sometimes just for fun.” “Schoolwork, weather information, and fun stuff.” “Homework, studying, and updating on sports.”

When asked to assess their skills in using different types of software, the Laptop students rated themselves the highest in word processing (78% very well), followed by an encyclopedia (67%), and Power Point (66%). The lowest skill ratings were in association with a calendar or telephone book (23% “not well at all”), followed by Fun Brain/Blackboard.com/Homework (21%), and Database (16%).

The three final survey items were open-ended. The first asked students what they felt were the best aspects of the Laptop Program. As seen in Table 13, the majority of the responses (56%) indicated that the laptop made school work easier, faster, and more varied due to the use of the internet and CD resources. The next most common response was playing games and visiting new web sites. Included in Table 13.1 are sample responses received for this item. For all such tables, we list the actual responses without correcting for spelling or grammar.

Table 13.1

Laptop Student Survey: Summary of Open-Ended Comments (n = 257)

Question: What is the best thing about having a laptop computer?

Response Categories	Number of Responses	Percent of Total Responses
Makes schoolwork easier/faster to do	143	56%
Playing games online/internet websites	41	16%
Learning new things/Makes learning fun	16	6%
Instant Messenger, Chat, E-mail	15	6%
General positive statements – “using it”	12	5%
Can take it anywhere	10	4%
Good for the future/Learn new technology	8	3%
Helps with typing/writing skills	7	3%
Negative/nonsense comments	5	2%
TOTAL	257	100%

Sample Responses

What is the best thing about having a computer?

- It easier to turn in school work on time because we can usually e-mail it almost right away
- We don't have to go to a computer lab and look up stuff because we can just do it on our laptops.
- I type better than I write so I can finish homework faster.
- It makes everyone's handwriting the same. Mine is terrible.
- If you lose a paper you can always print it again
- I like using it instead of a pencil or book.
- I have more research options
- You can make your work look very neat and organized. I like Microsoft Excel, which is very useful for organizing data and creating graphs in Science and Math.
- Reports look neater and I have spell and grammar check so all my things make sense
- Do more things at the same time, and it's easier to read instead of other people's handwriting.
- You can e-mail your teacher
- No waiting for your turn on the computer at home to do your homework or to print things.
- At school, you don't have to go to the computer lab. You don't have to go down to the library to get information on things your researching on.
- Makes learning more interesting and convenient.
- The best thing about having a laptop is to have the world in my lap.
- It just makes learning more fun and different.
- It's always fun to do writing assignments or research projects on a computer rather than with paper and pencil or with paper back books.
- The best thing is learning. There is always an interesting thing to learn.
- It teaches me a lot about upcoming and up-to-date technology.
- There is always something new to explore, and it is updated.
- It's like having everything you need at your finger tips. E-mail for talking, Outlook for organization, Word for home work. Having a laptop is really great.
- You can put your own stuff on it and you can take it anywhere
- You can take it home, and leave papers that can wrinkle and heavy books at school.
- It helps me with my writing skills
- My word-processing skills have improved greatly from typing so much, on a daily basis
- I love the computer and use it all the time! As I write it helps me so much by opening doors.
- You can go on the internet and have a better time writing stories.

The next question asked about the hardest part of the Laptop program. Almost half (42%) of the students responded that it was heavy and difficult to carry when combined with books and band instruments. Less frequent comments referred to computer breakage, slow and/or poor service, keeping the laptop maintained, and learning how to use it. Representative responses to this question are seen in Table 13.2.

Table 13.2

Laptop Student Survey: Summary of Open-Ended Comments (n = 257)

Question: What is the hardest part about having a laptop computer?

Response Categories	Number of Responses	Percent of Total Responses
Carrying it to school	107	42%
Breaking down/poor service/poor choice of computer	32	13%
Maintaining it/Having to be careful with it	23	9%
Learning how to use it	22	9%
Losing work/Freezes	19	8%
Typing/Having to do work on it	10	4%
Nonsense comments	7	3%
No hardest part	9	4%
General comments – “hard to use”	8	3%
Finding things online	5	2%
Don't use it enough	3	1%
Access/Database	3	1%
Can't play games at school	4	2%
TOTAL	252	100%

Sample Responses

What is the hardest part about having a computer?

- HAULING THE THING TO SCHOOL EVERY STINKING DAY!!!! SOMETIMES, I ALSO HAVE TO CARRY A BASSOON ALONG WITH IT!!!! DO YOU KNOW HOW MUCH MY SHOULDERS HURT AFTER CARRYING THOSE THINGS HOME???!!!!
- Carrying it on the bus to and from school.
- It is heavy and i get blisters on my hand!!!
- Putting it away every morning and packing it up every night. It is a hassle to carry it evrywhere.
- When you can't print so your work is late, or you have to have someone else print it for you.
- It has been in service 9 or 10 times. It's a lemon. It's way overpriced. The warrenty hardly covers anything.
- It takes me forever to get my computer back when i send it for repair.
- When it breaks i have to take it to get fixed and then, in the nxt week i have the same problem that i had the week before.
- If the computer breaks and you have to take it to the shop and you don't get a loaner.
- They're cheap, always break, are expensive, and a rip off ...our parents think we break them when its the laptop. for example the disk drive always break when we dont even use it
- You have to treat it like a little baby protect it from weather, never drop it, make sure it's safe.

- Someone can trip over the cord and either pull your computer off, or break the plug-in peg to always make sure you haven't lost it!
 - Being responsible...but please don't eliminate it
 - To remember to charge it at nights, because there's so much going on while doing your homework.
 - Is learning how to type
 - Using excel for formulas because I am not good at that and I don't like messing them up.
 - When it will not do what you want!!!!!!!!!!
 - Trying to get use to all the programs, because all the programs don't work the same way.
 - If you loose something and you didnt save it to disk.
 - Sometimes it can freeze, and sometimes it can do other funky things.
 - I can't type all the fast.
 - You get more work and the internet home work and projects.
 - You have to do almost every thing on it
 - Trying to resist games
 - Being seperated from the new kids when you are in middle school dont meet a lot of new people
-

When students were asked what they would change about the Laptop program, the responses were fairly equally distributed across five areas. The students wanted less restrictions and rules regarding the use of games and the internet, more time to use the computers during class, a different brand of laptop, and computers that were lighter and easier to carry. Sample student responses are found in Table 13.3.

Table 13.3

Laptop Student Survey: Summary of Open-Ended Comments (n = 257)

Question: If you could change anything about having a laptop and using it in school, what would you change?

Response Categories	Number of Responses	Percent of Total Responses
Less restrictions on games/free time and internet use	46	20%
Use computer more (more subjects) at school	44	19%
Change brand/hardware on laptop	44	19%
Make it lighter/Leave it at school	36	16%
Wouldn't change anything	35	15%
Not as much Homework	8	4%
Not sure/Don't know	4	2%
Upgrades	4	2%
Nonsense comments	3	1%
To not have it	2	1%
TOTAL	226	100%

Sample Responses

If you could change anything about having a laptop and using it in school, what would you change?

- Use it a lot more often than just in Lang.Arts and science. Like in math and S.S.
- Do more interesting things with it.
- Be able to keep it at school when we don't have any homework
- Use it everyday
- More webquest things
- Have more things on it like Microsoft Publisher.
- Going on the internet more often
- I wish we could download stuff and play games when we are done with our work.
- To install games on my computer.
- Change the fact that we can not use e-mail during school
- Listen to music on our computers more.
- Take your internet card home
- Use instant messenger
- Get a little free time on our computers instead on none at all.
- Getting to pick whatever kind of background we want that is appropriate
- Allow headphones while working.
- Take some of the site restrictions off
- Do math on it and not on paper.
- Change the modem
- More memory and make them faster.
- Leave it at school if you want to
- Make it smaller and lighter.
- Put books on CDs so we only have to take home our laptops - since most worksheets are online
- Tell us the days we will use it so we don't have to carry [it] all over the place for nothing.
- The school to have laptops..So, you don't always have to take the computer home.
- Not as much homework.
- Change the type of laptops. I mean we payed 1600 dollars for a 466 mhz and only 4.6 gigabyte computer. You can buy other laptops for 800 dollars and get a 3d fx card, special sound card, 1.0 ghz, and a 25 gigabyte hard drive.

The final item asked students if they had any other comments. The majority (35%) of the comments were positive affirmations that the students liked or loved having a laptop. Students also indicated that they wanted the program to continue but include all students (20%). A few students (14%) restated that it would be better if different computers were used. A summary of responses to this question are in Table 13.4.

Table 13.4

Laptop Student Survey: Summary of Open-Ended Comments (n = 257)

Question: Any other comments?

Response Categories	Number of responses	Percent of Total Responses
Like/Love having a laptop computer	29	35%
Continue laptop program – but include others	16	20%
Change Brands/Update/Different Hardware	14	17%
Helped with Learning	5	6%
Non-related Comments (I hate band; la la la)	8	10%
Not used enough	6	7%
Negative Comments	2	2%
Teachers need better computer skills	1	1%
Good program, but expensive	1	1%
TOTAL	82	100%

Sample Responses

Any other comments?

- I love having a computer to use at school!! It makes me a lot more interested in school, and i get better grades.
- I think that the laptop program is a very good way of teaching kids computer skills at a young age so that when they are older they understand computers more and be more up with technology.
- I think the laptop program is the best thing that happined to me about school
- For anyone who thinks laptops is a bad idea because they're expensive, well it's worth it.
- The laptop Program ROCKS!!
- I like the laptop program and I hope it will last until High School!
- Keep the program, it is worth it!
- I hope that they always have the laptop classes!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
- Dont take it away from me please i will be so sad
- I think that the laptop program is very good, but expensive
- I think the laptop is one of the most important tools anyone could ever use in their life. It is not just for games, you can do a lot of things with it. You can use the internet for e-mail and searches. You can use encyclopedias to do research and cut and paste pictures and text. You can also use programs to help you keep track of things. You can use Microsoft word or another word processor to write stories, reports, letters, or any other use for writing. You can use microsoft excel for excel graphs, formulas, or other uses. You can use Microsoft power point for power point presentaions and make them as cool as you want to be. You can use print shop to make greeting cards, calandars, posters and banners, or any other form of art known to mankind. Some people think that they don't need the laptop or personal computer. Well I didn't just type a whole paragraph about computer programs just for nothing. You do need the laptop and personal computer for a lot of uses. I just hope those people learn just one thing about the laptop or any other computer, one day, you'll need the technology of computers to help in everyday life, and the computer will be there to help change your life. One day,technology will help run all of our lives and soon, technology will help run the world.
- I think that we should have more free time with our laptops at school because we do pay for these things.
- Some classes get to use their laptops more often the others
- I think that the teachers should take computer courses during the summer or something. They are constantly coming to me and asking me questions about the computers. They want me to create assignments on the computers for them. It gets annoying after awhile.
- I think that we don't use our laptops that much and it is a shame that our parents pay so much and all we do is go on word for a little while and every now and then we will create a powerpoint.
- The laptops aren't very good - we never use them. The server is always down, and I personally think it is a waste so continue the program.

Overall, the survey results show that laptop students were highly appreciative of having laptop computers and were taking advantage of its resources for performing a variety of learning activities both at school and at home. Combinations of both independent and cooperative computer work took place for most students. The internet was regularly used for both school work and other activities. Skill development was strongest for word-processing, encyclopedia, and Power Point.

Computer-Extended. A total of 134 students, 73 in Grade 6 and 60 in Grade 7, completed the student survey. The majority (57%) were female. Table 14 summarizes the responses. Chi-square tests of independence were conducted to determine the relationship between item responses and group (Laptop vs. CE). Significant results are noted below in conjunction with the reporting of the descriptive findings.

Table 14

Summary of Descriptive Statistics for Computer-Enhanced Student Survey

	None	Somewhat	A lot more
My computer skills are better because I have a computer.***	7.5%	38.3%	54.1%
Using a computer has made me more interested in learning.***	29.8%	51.1%	19.1%
Because I have a computer, I now want to get better grades.*	47.4%	30.1%	22.6%
My writing has improved because I use a computer.***	51.9%	33.1%	15.0%
I can now do internet research to find information.	4.5%	23.1%	72.4%
A computer makes it easier to work with other students.***	32.6%	43.2%	24.2%
I am very glad that I have a computer.	5.3%	14.3%	80.5%
I want to use a computer again next year.*	12.1%	22.7%	65.2%

	Never	Once a week	Several times a week	Almost everyday
How often do you use a computer in the following ways while in the classroom?				
By yourself ***	26.4%	25.6%	16.3%	31.8%
With one other student ***	54.7%	29.7%	11.7%	3.9%
With a group or team ***	62.8%	25.6%	9.3%	2.3%
How often do you use a computer in the following subjects? ***				
Language Arts***	32.8%	44.3%	13.7%	9.2%
Mathematics ***	83.7%	11.6%	2.3%	2.3%
Science ***	45.8%	35.9%	8.4%	9.9%
Social Studies ***	53.8%	22.3%	10.0%	13.8%
About how often do you use a computer for homework? ***	24.6%	41.0%	14.2%	20.1%
How often do you use a computer for things other than homework? ***	6.0%	14.2%	27.6%	52.2%
How often do other family members use a computer?***	11.5%	14.5%	28.2%	45.8%
			Yes	No
Do you have the internet at your home?			90.1%	9.9%

	Never	Once a week	Several times a week	Almost everyday
If yes, how often do you use the internet for schoolwork?***	32.8%	46.9%	9.4%	10.9%
If yes, how often do you use the internet for things other than schoolwork?*	6.5%	20.3%	19.5%	53.7%

Table 14

Summary of Descriptive Statistics for Computer-Enhanced Student Survey (continued)

	Not at all		OK		Very well
How well do you use the following software?					
Database (Access)**	32.3%	7.9%	30.7%	12.6%	16.5%
Drawing*	13.5%	12.8%	27.8%	19.5%	26.3%
Email**	12.1%	4.5%	8.3%	8.3%	66.7%
Games	3.8%	2.3%	12.1%	17.4%	64.4%
Fun Brain/Blackboard.com/Homework site***	42.4%	12.9%	21.2%	11.4%	12.1%
Internet searches**	8.3%	7.5%	21.8%	16.5%	45.9%
Power Point Presentation***	21.8%	14.3%	17.3%	18.0%	28.6%
Excel (or a Spreadsheet)***	34.4%	19.8%	14.5%	12.2%	19.1%
Microsoft Word (or a word processor)***	5.3%	2.3%	17.3%	15.8%	59.4%
Encarta or other encyclopedia on your laptop***	13.5%	13.5%	14.3%	15.0%	43.6%
A calendar or telephone book**	30.1%	9.0%	16.5%	12.8%	31.6%

* $p < .05$, ** $p < .01$, *** $p < .001$

Regarding Program Impacts, most of the CE students (54%), but significantly ($p < .001$) fewer than the Laptop group (75%) felt that their computer skills had increased as a result of having access to classroom computers. The CE students tended not to feel as strongly as Laptop students that access to computers increased their interest in learning ($p < .001$) and in earning better grades ($p < .05$). About half (compared to three-fourths of the Laptop group) felt that using school computers improved their skills to some degree in writing ($p < .001$). The majority (80%) were highly positive about having access to classroom computers and having the skills to do internet research (72%). Although 65% wanted to use computers again in class next year, this response was less positive ($p < .05$) than the 78% agreement by the Laptop group.

Only 32% of the CE students, as compared to 46% of the Laptop students, worked with the computer by themselves every day ($p < .001$). However, almost half (48%) of the

CE group reported using a computer individually at least several times a week. In general, they had relatively few opportunities compared to Laptop students to work with another student ($p < .001$) or with a team ($p < .001$). The most common subject for computer use in CE classes was language arts (67% at least once a week) followed by science (54%). Still, for each of the subjects listed on the survey, CE students conveyed significantly less ($p < .001$) usage than did Laptop students.

About one-third (34%) of the CE students reported using the computer at least several times a week for completing homework, while 79% reported regular uses for “other things.” Laptop students, by comparison, were higher in homework usage ($p < .001$) but lower in “other area” usage ($p < .001$). Interestingly, about 89% of the CE students compared to only 31% of the Laptop students reported use by other family members at least one time a week ($p < .001$). The implication is that laptops did not serve a critical role in stimulating family involvement with computer use.

Nearly all (90%) CE students reported having access to the internet at home. There was moderate reported use of the internet access to complete homework (20% at least several times a week compared to 47% for Laptop students, $p < .001$), but more frequent use of the internet for “things other than schoolwork (54% “every day” compared to 39% for Laptop, $p < .05$).” When asked to describe how they use the internet at home, the responses fell into the same categories as the laptop students, homework, chat sessions, and games. However, the distribution of responses were different in that chat sessions (39%) and games (35%) were cited more frequently than homework (26%). Another difference in CE responses was that when homework was cited, it was often mentioned as something that was only done

occasionally, as seen in the following responses: “I use it [internet] a little for homework.” “Once in a while for homework.” and “Sometimes, if needed, I use it for homework.”

CE students rated their skills most positively in e-mail (67% very well), followed by games (64%), and word-processing. In contrast to Laptop students they were not as confident about using encyclopedia software (44% very well vs. 67%) or using Power Point 29% vs. 66%). The lowest skill ratings were in association with Fun Brain/Blackboard.com/ Homework (42% not well at all), Excel (34%), and database software (32%). Laptop students tended to rate themselves significantly higher ($p < .05$ or higher) in skills than did CE students on the majority of software types: database, drawing, Fun Brain/Blackboard etc., internet searches, PowerPoint, Excel, word processing, encyclopedia, and calendar/telephone book.

As with the laptop students, the CE survey ended with three open-ended questions. The first item asked students to describe the best thing about using school computers. Nearly half (47%) of the CE student responses, as compared to only 16% of the Laptop responses, indicated that the best part of using computers was playing games, surfing and downloading from the internet, and playing music. Student responses that indicated the best aspect of computers was helping with schoolwork were somewhat more similar, but with Laptop having a higher percentage (44% CE; 56% Laptop). A summary of responses can be seen in Table 15.1.

Table 15.1

Computer-Extended Student Survey: Summary of Open-Ended Comments (n = 134)

Question: What is the best thing about using school computers?

Response Categories	Number of Responses	Percent of Total Responses
Download/Play games/Surf/Music	54	47%
Helps with Schoolwork	51	44%
General fun	10	9%
Paint program	2	2%
TOTAL	116	100%

Sample Responses

What is the best thing about using school computers?

- Go to websites, check emails, games, just something to do.
- Fun and easy and you can do any thing you want to do on the internet and on the computer.
- Finding out all the different things you can do online you wouldnt be able to do anywhere else.
- Playing games and going online.
- You can get your work done easier
- You get stuff done faster
- You don't lose stuff because it's saved on your computer.
- Can keep up with every thing that is going on in the world that you don't know
- It easier than having to go to the library and look up what I need in a book.
- It helps me because i have really slopy hand writing and i am not that good at spelling so it helps me with me spell cheak
- You can do a lot more things on the computer than you can on paper.
- It's cool, fun, amusing, and helpful.

There was less similarity between the CE and Laptop student responses with regard to the hardest part about using school computers in that the Laptop students referred to the physical aspects of carrying and taking care of the laptop. However, beyond that, both the CE students and laptop students agreed that the hardest things about using computers were: lockups/freezes (31% CE; 8% Laptop), learning to use them (21% CE; 9% Laptop), typing (6% CE; 4% Laptop) and finding things (5%; 2% Laptop). Responses that were not mentioned by Laptop students include that it was hard to share the computers with other students (14%) and that they are slow (21%). The summary of CE student responses to this item are in Table 15.2.

Table 15.2

Computer-Extended Student Survey: Summary of Open-Ended Comments (n = 134)

Question: What is the hardest part about using school computers?

Response Categories	Number of Responses	Percent of Total Responses
Locks up/freezes	25	31%
Too slow	17	21%
Difficult to use	16	20%
Sharing with others	11	14%
Typing	5	6%
Not being able to find things	4	5%
I don't know	2	3%
TOTAL	80	100%

Sample Responses

What is the hardest part using school computers?

- When it shuts off by itself and erases everything that you put on it before.
- You have to find information on stuff and you can not find it.
- It isn't as quick as looking something up in a book, and it breaks easily.
- It takes a long time to boot up.
- Having to wait for an internet page to load
- It is so slow
- Sometimes its confusing!
- Learning how to do everything
- When it doesn't do what you want it to
- Having so many people on the computer when you want on.
- If it breaks then you dont have one to use and you have to find someone to partner up with when we do internet activities
- It takes longer to type then writing

When the students were asked what they would change about using computers at school, the CE and Laptop students agreed that they wanted to use computers more frequently (38% CE; 19% Laptop) and wanted less restrictions on using games and the internet (9% CE; 20% Laptop). Approximately one-fourth of the CE as compared to 15% of the Laptop responses indicated that nothing needed to be changed with regard to using computers (laptops) at school. CE student responses that were not seen on the Laptop survey included getting newer/faster computers (19%), having a computer for all students (4%), not having to type (3%), and playing more games (1%).

The final item on the CE Student Survey asked for “Any other comments?” A total of 24 comments were given with the majority (54%) being non-constructive, such as, “I like girls” or “I would like to say ‘Hi’ to whoever is reading this.” For 11 of the responses, however, students indicated that they liked the internet (25%) or liked computers in general (21%). A summary of the responses regarding changes to using school computers and additional comments are in Table 15.3.

Table 15.3

Computer-Extended Student Survey: Summary of Open-Ended Comments (n = 134)

Question: If you could change anything about using school computers, what would you change?

Response Categories	Number of Responses	Percent of Total Responses
More computer/internet use	44	38%
Nothing	30	26%
Hardware/Components	22	19%
Fewer restrictions	11	9%
Every kid should have a computer	5	4%
Not having to type	3	3%
Play more games	1	1%
TOTAL	116	100%

Sample Responses

If you could change anything about using school computers, what would you change?

- There isnt always internet access.
- I would change the curriculum of the subjects so that they relate to more work on the computer. The computer teaches professionalism and how to live in the outside world. Everything now today deals with a computer. Even working at McDonald's uses a computer to ring up the order which people think it is a nothing job, but it still uses technology which needs to be taught more in the classroom.
- More sites on the internet about subjects like science and other subjects.
- I personally think that computers are great the way they are.
- I would change all the annoying meessages your computer sends you when it's not working.
- I would be in the laptop program
- Faster computers
- Have all good programs
- That everyone in the school gets a computer no matter what and to lower the priceof the computers. and that the school board provides the computers for ALL the students.
- Everyone has free laptops
- More acsess for all students.
- Not having to do word processing cause most people can't type that good
- Can check email in school
- I wish that we could have more assingments on the computer.
- More access to a computer. Nothing about the computer
- Use it more in school for projects.
- Type up more things then just writing them on paper

Question: Any other comments?

Response Categories	Number of Responses	Percent of Total Responses
Liked the internet	6	25%
Liked computers in general	5	21%
Non-constructive comments	13	54%
TOTAL	24	100%

Sample Responses

Any other comments?

- Internet is really fun!
- I love going on the computer.
- I would like to have better computers
- I looooooovvvveeeee the inna'net!
- We really need to be able to use computers more

These results show that the CE students were acquiring regular computer experiences but in ways less diversified in scope and less connected to everyday classroom instruction. The CE students felt positively about using computers and were fairly regular users of the internet, albeit mostly for activities other than school work. They mostly worked with computers individually, and viewed themselves as skilled in more routine software applications such as e-mail, games, and word processing. Their perceived skill levels with more sophisticated tool software was consistently less than that of the Laptop group.

STUDENT FOCUS GROUPS

The researchers conducted six student focus groups (3 Laptop; 3 CE) that involved a total of 71 students (38 Laptop; 33 CE), with the size of each session ranging from 5 to 27 students. Focus group questions covered overall impressions, classroom-level changes, impacts on students, and parent support for either having laptop computers or access to school computers (CE students).

Laptop Students. When the Laptop students were asked how it had been to have a laptop this year, students were very positive and indicated that the best things about having the computer were: easy access to online resources, ease of creating and editing work, and ability to make assignments look much better. Students indicated that the worst aspect of having the laptop was dealing with technical difficulties and carrying it to and from school.

All of the students indicated that the laptop had influenced classroom level changes in that they did more projects, were required to do more research, to think more, write more, and were sometimes engaged in more cooperative learning. The students also reported that rubrics are used more frequently; however, the 7th grade students indicated that this form of assessment was used with larger projects rather than everyday assignments. When asked if having the laptops had influenced their personal learning, student responses were positive, with some indicating that it had helped them to be more organized and that access to online resources had increased their knowledge. Responses were mixed with regard to the impact on student-to-student or student-to-teacher communication, with some stating that it had increased from the use of email and instant messenger while some indicated no noticeable changes.

The final portion of the student focus group asked how the laptop had impacted the parents and/or family members. Students reported that the parents were generally very positive about the program but that some got frustrated when the laptop was not working or repairs took too long. Specific responses indicated that parents felt it would help students in the future, liked the portability of the laptop to take it on vacations, and were impressed with child's technical knowledge and skills. When asked how other family members reacted to the program, the most common reply was "jealousy." The students felt that communication

between parents and teachers had not really increased but many indicated that the form had changed from face-to-face to email correspondence.

When asked if they had any other comments, the following responses were among those given:

- If you don't have your laptop, you might as well stay home for the day.
- You should give others the chance to use the laptops.
- I participate and pay more attention in school because it is more fun.
- We will be able to get a better, more fun job because we know more about using computers.

Computer-Extended Students. The CE focus groups asked the same questions as those in the Laptop groups, but the questions focused on having computers in the classroom. In general, the students liked having computers in their classroom, stating that the best part was it is easier than writing assignments with paper and pencil, that research is easier, and that they like the spell-checker. The worst part was that students often having to wait to use a computer, forgetting to save work, and experiencing technical difficulties.

The student responses were mixed with regard to whether or not having classroom computers had caused an increase in project work, required research, amount of writing, working with other students, or the use of portfolios and/or rubrics. Some indicated an increase in use and others reported no changes. Similar mixed responses were given when asked about the impact of the computers on student learning, with some saying learning was improved while others indicating there was no notable change. For example, 7th graders indicated that there was little if any difference between using information from the internet or from books. When asked if the computers had changed the way students and teachers relate

to each other, some stated that they relied less on the teacher because research was done more independently. The CE students reported that in general their parents supported the use of classroom computers. However, a couple of students said their parents “didn’t care” or felt it was “a waste of money.” The students did not have additional comments to add to the ones already provided.

TEACHER SURVEY

The teacher survey was administered to Laptop teachers ($n = 8$) only. Results are summarized in Table 16. As a group, the teachers conveyed very positive reactions about the benefits of the Laptop for their effectiveness as teachers and for their students as learners and technology users. All (100%) agreed that the program experience increased their personal ability to: use basic computer applications, create lessons that integrate student use of computers, and integrate technology into lessons that were previously taught without computers. About two-thirds agreed that they had increased their emphasis on higher-level learning in the classroom (63%), their emphasis on project-based learning (63%) or interactions with parents and students (63%) as a result of participating in the Laptop program. All teachers agreed that being in the Laptop program was personally beneficial, and that they would like to participate in the program again next year.

Table 16

Summary of Descriptive Statistics for Laptop Teacher Survey

Personal Impact	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I have increased my personal ability to use basic computer applications, such as Access, Excel and PowerPoint.	0.0%	0.0%	0.0%	37.5%	62.5%
I am better prepared to create lessons that integrate student use of computers.	0.0%	0.0%	0.0%	50.0%	50.0%
I frequently integrate technology into lessons that I previously taught without the use of computers.	0.0%	0.0%	0.0%	50.0%	50.0%
I have increased the frequency or emphasis of higher-level learning in my classroom instruction.	0.0%	0.0%	37.5%	25.0%	37.5%
I have increased the frequency or emphasis of project-based learning.	12.5%	0.0%	25.0%	25.0%	37.5%
My school-related interactions and communication with students and parents have increased.	0.0%	0.0%	37.5%	37.5%	25.0%
Overall, being a teacher with the laptop project has been beneficial to me.	0.0%	0.0%	0.0%	25.0%	75.0%
I would like to participate in the laptop project again next year.	0.0%	0.0%	0.0%	0.0%	100.0%
Student Impact	Reduced Same Increased				
To what degree has having access to laptop computers impacted the students?					
Interest in learning			0.0%	12.5%	87.5%
Performance and /or grades			0.0%	37.5%	62.5%
Writing skills			0.0%	0.0%	100.0%
Research skills			0.0%	0.0%	100.0%
Ability to work with other students			0.0%	25.0%	75.0%
Student Use	Never	2	3	4	Frequently
How often do your students use the laptop in the following ways?					
Individually	0.0%	0.0%	0.0%	0.0%	100.0%
In pairs	0.0%	0.0%	25.0%	37.5%	37.5%
In groups of three or more students	12.5%	25.0%	12.5%	12.5%	37.5%
How often do your students use the laptop for the following subjects?					
Language Arts	0.0%	0.0%	12.5%	0.0%	87.5%
Mathematics	16.7%	33.3%	16.7%	16.7%	16.7%
Science	0.0%	0.0%	40.0%	0.0%	60.0%
Social Studies	0.0%	0.0%	14.3%	14.3%	71.4%

Table 16

Summary of Descriptive Statistics for Laptop Teacher Survey (continued)

How often do your students use the following software?					
Word Processing (e.g.. MS Word)	0.0%	0.0%	0.0%	0.0%	100.0%
Drill and Practice	42.9%	14.3%	28.6%	0.0%	14.3%
Tutorials	25.0%	37.5%	25.0%	0.0%	12.5%
Games	0.0%	50.0%	0.0%	12.5%	37.5%
Email	25.0%	0.0%	25.0%	25.0%	25.0%
Internet	0.0%	0.0%	12.5%	25.0%	62.5%
Database(e.g. MS Word)	12.5%	37.5%	12.5%	25.0%	12.5%
Spreadsheet (e.g.. Excel)	12.5%	0.0%	25.0%	37.5%	25.0%
Desktop Publishing	14.3%	14.3%	14.3%	14.3%	42.9%
Presentation (PowerPoint)	0.0%	0.0%	12.5%	37.5%	50.0%
Draw/Paint/Clipart	0.0%	0.0%	25.0%	25.0%	50.0%
Authoring: HyperStudio, etc.	50.0%	0.0%	12.5%	25.0%	12.5%

With regard to the impact on students, there was unanimous agreement that participation in the Laptop program increased students' writing skills and also their reading skills (both 100%). The majority of teachers (87%) perceived increases to occur in students' interest in learning (88%), ability to work with other students (75%), and performance/grades (63%). Not surprisingly, none of these areas was believed to have been negatively impacted by students' participation.

Corroborating the student survey responses, all teachers (100%) indicated that students "frequently" use the laptop computers individually. Fairly regular computer usage was also described as taking place in pairs and in groups of three or more students (see Table 16). Teachers also confirmed students' perceptions that language arts was the subject most commonly addressed by computer activities, with slightly less but still frequent use for science and social studies.

The final section of the survey concerned student usage of different types of software. Teachers indicated that the software *most* frequently employed was word-processing (100% rating of “4” or “5”), internet (88%), presentation (88%), and draw/paint/clipart (75%). Software *least* frequently used was authoring (50% rating of “1”) and drill-and-practice (43%).

Three open-ended questions were included in the final section of the survey. The first asked teachers what they felt was the greatest benefit of the laptop program. The teacher responses fell into two categories, technology and learning. With regard to technology, the teachers felt it was very beneficial for students to have access to technology and the information made available via the internet. The teachers also felt that use of the laptop had resulted in students having greater research skills, improved writing skills, greater interest in school, and greater self-confidence. The difficulties cited were all related to the technology itself. Teachers felt that technical difficulties related to power, weight, drives, server, and printers negatively impacted the program. They were also concerned with students tampering with software and the laptop settings. As could be expected, teachers indicated that the program could be improved by providing more technical support, more basic training, more projectors, and a solution to the power problems. Overall, the teachers were positive toward the program.

TEACHER INTERVIEWS

A total of six teacher interviews were conducted with one randomly-selected Laptop and CE teacher from each grade level (5th, 6th, and 7th). As with the other instruments, the questions addressed the most positive and most difficult aspects of the laptop program and

how it had impacted classroom practices, student learning, and the teachers. A summary of the laptop and CE teacher responses follows.

Laptop Teachers The three Laptop teachers were very positive with regard to overall laptop program. They felt that the most effective aspects of the program were improved ability of students to use the computer and to conduct internet-based research. There was general agreement that the two most difficult aspects of the program were monitoring use of the internet and technical difficulties, yet each teacher indicated that the “positives of having laptops outweigh the negatives.”

When asked how laptops had impacted classroom activities, responses from the teachers were supportive. At the 5th grade level, students were more eager to engage in project-based activities, worked more cooperatively during projects because they could email products to team members, and were better able to “find current information quicker.” The 5th grade teacher also indicated that students were better writers because students “are not afraid to write – they can delete and redo a paper much easier.” At the 6th grade, the teacher reported that more science and social studies projects were assigned, more cooperative learning was used, and student writing skills had improved. The teacher also indicated that the degree of higher-level learning had increased because “I expect more out of my students.” The 7th grade teacher felt the laptops enhanced student research skills, ability to work together, and interdisciplinary learning because content area information, such as in social studies, could be transferred into graphing software to reinforce math skills. This teacher was less certain that writing was positively impacted due to student reliance on grammar and spell check tools. There was general consensus across the three grade levels that laptops had not had an impact on the use of authentic assessments.

CE Teachers The classrooms of the three CE teachers each had five computers available for student use. The interview focused on the impact of these computers. Overall, the teachers were supportive with regard to the computers, but indicated a desire for more computers to decrease the student-to-computer ratio. The most effective aspects of having computers were noted as access to the internet and assignments that were word processed and thus easier to read. Like the Laptop teachers, the CE teachers felt that the most difficult aspects were management of student internet use and equipment failures. However, unlike the Laptop teachers, they also experienced difficulty due to student unfamiliarity with computer use.

The CE teachers were mixed concerning positive impact of computer use on classroom activities, students, parental support, and the teachers themselves. The 5th grade teacher indicated an increase in the use of projects, higher-level learning, student research skills, and peer support. Regarding impact of the computer on student writing, the 6th grade teacher felt it was positively impacted while the 7th grade teacher felt that students “think the grammar and spell check are sufficient, so they are not as willing to correct their papers.” All three indicated little if any impact of computers on the use of cooperative learning or authentic assessment.

Teacher responses with regard to impact of classroom computers on students were again mixed. The 6th grade teacher indicated that students “stayed on task, listened, focused, and worked harder when using computers.” The 7th grade teacher, on the other hand, reported that students, “become irritated when equipment does not work, fight over time constraints on the computer, and are disgruntled about lack of supplies (e.g., ink, paper).” All agreed that computers were used for communication with students and parents, but not that this

communication was an improvement over non-computer communication. Regarding impact of the computers on the teachers, all reported increased sharing of computer resources and ideas with other teachers. They also indicated increased classroom management demands due to technical difficulties and lack of personal and student technical skills.

PARENT SURVEYS

A total of 96 parents (66 Laptop; 30 CE) responded to the Laptop survey, 86 via an online version and 10 via paper-pencil. Responses for each group are discussed below.

Laptop parents. The grade levels of their children represented in the sample were 9% 5th grade, 68% 6th grade, and 23% 7th grade. About 5% of the parents indicated that their child was in special education, and only 2% indicated that their child was an English-as-Second-Language (ESL) student. The majority of respondents were parents of male students (61%). Responses are summarized on Table 17.

Table 17

Summary of the Descriptive Statistics for Laptop Parent Survey (n = 66)

	Never	Rarely or Occasionally	1-2 days per week	3-4 days per week	Every day
The Laptop					
About how often does your child do school work with the laptop at home?	0.0%	10.8%	33.8%	35.4%	20.0%
How frequently does your child use the laptop for things other than homework?	0.0%	15.4%	27.7%	29.2%	27.7%
How often does your child take the laptop to school?	0.0%	0.0%	3.1%	0.0%	96.9%
Other computers					
Are other computers in your home?				Yes 98.5%	No 1.5%
		1	2	3	4
If yes, How many?	53.1%	28.1%	15.6%	3.1%	
				PC	Mac
Type?				98.4%	1.6%
				Yes	No
Printer?				98.5%	1.5%
The Internet					
Can you access the internet with the laptop for schoolwork?				63.6%	36.4%
	Never	Rarely or Occasionally	1-2 days per week	3-4 days per week	Every day
If yes, how often does your child use the internet for schoolwork?	4.9%	37.7%	32.8%	19.7%	4.9%
If yes, how often does he/she use the internet for things other than schoolwork?	5.8%	11.5%	26.9%	30.8%	25.0%
How frequently do you or other family members use the internet for things other than your child's schoolwork?	1.6%	8.1%	16.1%	21.0%	53.2%
	NA	Reduced	Same	Increased	
Does the laptop help?					
To what degree has the laptop computer changed your child's:					
interest in school?	4.5%	0.0%	39.4%	56.1%	
achievement in school?*	0.0%	6.1%	45.5%	48.5%	
involvement in project-type school work?	0.0%	1.5%	40.0%	58.5%	
writing skills?**	1.5%	6.2%	35.4%	56.9%	
research skills?	0.0%	3.0%	10.6%	86.4%	
ability to work with other students?	1.5%	1.5%	69.7%	27.3%	
The Laptop and Your Family					
To what degree has the laptop computer changed your or another adult's:					
involvement with your child's school work?	4.5%	13.6%	74.2%	7.6%	
interactions with your child?	3.0%	6.1%	71.2%	19.7%	
interactions with your child's teacher?	6.1%	6.1%	71.2%	16.7%	
communications with other parents?	9.1%	4.5%	83.3%	3.0%	
To what degree has the laptop computer changed your:					
involvement with projects your child does in school?	3.0%	24.2%	53.0%	19.7%	
your assistance with homework?	1.5%	23.1%	66.2%	9.2%	

Table 17

Summary of the Descriptive Statistics for Laptop Parent Survey (n = 66) (continued)

To what degree has the laptop computer changed other children's:				
involvement with their brother's or sister's schoolwork?	27.3%	1.5%	57.6%	13.6%
interactions with their brother or sister?	18.2%	3.0%	57.6%	21.2%
use of the laptop for their schoolwork?	36.4%	6.1%	31.8%	25.8%
Positive interactions between each other?	16.9%	4.6%	56.9%	21.5%
		Yes	No	NA
Has your child helped you with a project this year?		0.0%	61.7%	38.3%
Have you learned something about computers from your child this year?		0.0%	88.5%	11.5%

p<.05, **p<.01, *p<.001*

An initial set of questions concerned parents' perceptions of how their child used the laptop computers. The majority believed that the child used the computer at home for schoolwork (55% agreement) and for activities other than homework (57%) at least 3 to 4 days per week. Close to 100% (97%) indicated that their child took the laptop to school every day. Nearly all homes had at least one other computer, with the vast majority being PCs and connected to a printer.

About two-thirds of the laptop parents indicated that they could access the internet. Most believed that their child used the internet for both schoolwork and other activities at least 1 to 2 days a week. Interestingly, 53% of the respondents believed that they or family members used the internet every day for activities unrelated to school.

In reacting to the effects of the Laptop program on their child's school and learning activities, parents were generally quite positive. Benefits attributed to the program by over 50% of the respondents were improvements in their child's interest in school (56%), involvement in projects (59%), writing skills (57%), and especially, research skills (86%). Fewer parents agreed that the Laptop program changed *their* or another adult's interactions

with the child's schoolwork or with the school. However, close to 20% felt that they were more involved with classroom projects on which their child was working. Approximately 20-25% of the parents also increased sibling interactions at home. No respondents (0%) felt that they were directly helped by their child with a personal project or personal improvement of computer skills.

The Parent Surveys concluded with the same open-ended items as the Student Surveys, with the first item asking parents to describe the best thing about the Laptop program. As can be seen in Table 18.1, of all the responses, over one-third indicated that having the laptop had increased their child's level of computer skills, 31% felt the laptop had helped their child with school-related work such as research and writing skills, while 20% felt the laptop had helped increase other skills such as organization and ability to accept responsibility.

Table 18.1

Laptop Parent Survey: Summary of Open-Ended Comments (n = 66)

Question: What is the *best* thing about having a laptop computer available for your son/daughter?

Response Categories	Number of Responses	Percent of Total Responses
Increased computer skills	30	37%
Helps with homework/research/writing	25	31%
Increased other skills (besides computer)	16	20%
Transporting/Portability	5	6%
Provides an additional home computer	3	4%
Increased self-confidence	2	2%
TOTAL	81	100%

Sample Responses

What is the best thing about having a computer available for your son/daughter?

- Increased sense of responsibility regarding caring for the laptop.
- He is learning skills he will need all of his life.
- Increased her knowledge in computer technology and communication skills.
- An increase in computer literacy for not just the child with the laptop but the whole family
- Her ability to work with computers, all types, is unbelievable...this will do wonders for success in her future.
- He has learned how to type at an earlier age than I did.
- She is much better prepared for the real world.
- Amazed at how much they learn and how quickly. Wants to work on the computer for fun also.
- A variety of options to utilize for projects, keeping up with technology and it is interesting to use.
- Increase in ease to experiment with other programs like photoshop.
- Being able to do homework anytime and anywhere.
- It has made writing easier. The children are not as turned off by having to make rewrites.
- He has stopped complaining about writing and doing projects. He spends time creating his papers instead of rewriting them.
- It has made her more independent in doing her own school work
- The projects are easier for her to complete, without additional driving to and from the library.
- Increases vocabulary, students get to use thesauri and other online tools to increase the level of grammatical correctness.
- Enabled him to do higher quality homework and school projects, rather than spending 10 minutes trying to draw a neat graph he is able to spend that time researching and inputting data.
- I like the teachers using computers for contacting parents.
- It has greatly improved his reading spelling and writing skills.
- A dramatic increase in writing skills
- Helped my daughters confidence level and attitude towards herself.

As seen in Table 18.2, about one-fourth of the parent responses indicated that the worst aspect of having the laptop was that it was hard for their child to carry, especially when other books and band instruments also had to be carried. Approximately the same number (24%) felt that computer breakage and dealing with the selected service agent was the most

difficult aspect. Other comments included concerns that the laptops were not used enough for educational purposes (13%) and decreased their child's practice with handwriting, spelling, and library use (11%). Four responses (6%) indicated dissatisfaction with the focus of the laptop program in that computers needed to be used more frequently, in a more structured format, and that the program needed to be offered to all students. Seven responses (11%), however, indicated that the program did not have any negative aspects.

Table 18.2

Laptop Parent Survey: Summary of Open-Ended Comments (n = 66)

Question: What is the *worst* thing about having a laptop computer available for your son/daughter?

Response Categories	Number of Responses	Percent of Total Responses
Weight/Carrying it/Responsibility for breakage	16	25%
Breaking/Repairs	15	24%
Non-Educational Use (Internet/Games)	8	13%
Nothing	7	11%
Handwriting/Spelling/Library skills not practiced	5	8%
Program Focus (limited use, excludes some students)	4	6%
Not enough physical activity/other interests	3	5%
Makes child too independent – less parent help needed	2	3%
Teachers don't return emails	2	3%
Cost	1	2%
TOTAL	63	100%

Sample Responses

What is the worst thing about having a laptop computer available for your son/daughter?

- The worst thing is carrying it to school with all their other items, i.e., backpack, and instrument and trying to find seating space on the bus. The busdriver is packing 3 kids to a seat and in the winter its even worse with all the heavy clothing.
- Taking it to school every day even though she doesn't use it.
- I feel that it was too much responsibility for a 10 year old.
- Three repairs in less than one year, not due to negligence
- The service provider. They were rude, quick to judge and place blame. They also told me how much money they were losing to manage our laptop program.
- The computer support at the school isn't timely.
- My daughter's laptop was down for almost 3 weeks and they do not have loaners to use.
- The repairs! And lack of communication when a repair is made. Recently we had to replace the entire hard drive, we were not notified that this was being done and did not have an opportunity to save what was needed and everything was lost.

- The service provider does very poor work, and they are not customer friendly. Twice we have had our unit in for repair, and they have failed to notify us when it was done. On our last two service calls they failed to fix the problem.
 - When the laptop is being repaired it takes too long and there aren't enough loaners.
 - I can't think of anything negative to say about my son having a laptop available to him on a daily basis. He is enjoying school more and complains less about homework.
 - Can't site a negative. It has been very beneficial to our 6th grader.
 - It is still used mostly for desktop publishing and games...this did little to enhance my son's education.
 - Not able to work on improving his penmanship skills.
 - Lack of interest in anything else besides computer. Lack of physical activity.
 - Doesn't need my assistance as much, very independent
 - Students are not utilizing the library as much and will not be as effective in using the library for reference during projects.
 - It is a distraction for her to have too much freedom. Music CD's and instant messaging in the classroom is not making good use of this tool.
-

When asked how the laptop program could be improved, the three most common parent responses were to use them more frequently for academic purposes (28%), to change the company that provides service and repair to the computers (24%), and to continue the program, but make it available to all students (24%). Other suggestions included improving communication between parents and the teachers (9%), more uniformity in how the laptop program is implemented (6%) and more security against damage or misuse by others (4%). A summary of responses are in Table 18.3.

Table 18.3

Laptop Parent Survey: Summary of Open-Ended Comments (n = 66)

Question: What changes would you like to see in the Laptop Computer program?

Response Categories	Number of Responses	Percent of Total Responses
More educational assignments using computer	15	28%
Change the computer/repair people	13	24%
Continue the program/Make it available to everyone	13	24%
Better parental controls/involvement	5	9%
More uniformity among laptop teams	3	6%
More security against damage/misuse by others	2	4%
Provide more advanced computer classes	1	2%
Limit program to high school students	1	2%
Structure program so laptops can be left at school	1	2%
TOTAL	54	100%

Sample Responses

If you could change anything about your child having a laptop and using it in school, what would you change?

- Have computer technician(s) available during school hours who are capable of correcting any problems (repairs, etc.) within a reasonable amount of time.
- Better technical support with a more courteous staff...remembering that we are dealing with children using adult instruments.
- Change the vendor.
- I would like to see new computers of better quality like IBM,DELL,HP, etc.
- Reduce the cost of the computers
- To be able to upgrade the computer. My child's specs are out dated.
- On site service. Docking stations.
- I have a 4th grader who was unable to get in the 5th grade program do to limited space.I feel all children interested should be able to get into the program.
- Wish there was a way for every student who wanted one to be able to use one without an \$1800 charge to their family. Perhaps the school should have waited until they had the funds to purchase them for classrooms.
- The school has made some major mistakes in their implementation of this program. There is a separation between the "laptop" kids and the "nonlaptop" kids, and our district makes this separation wider by such things as having the "laptop" students in one hall, and all "nonlaptop" students in another. Technology is not the "be all and the end all" in education. It is simply another tool. I wish as much effort was put into my son's 5th grade math book selection as was put into this program.
- Carrying this program in to the High school level.
- Consistant use of it throughout ALL grad levels. Sixth grade used it alot but seventh grade rarely.
- More use for math and science---Excel
- I hope that over time more use will be made of the computers. Simply writing their reports in Word and PowerPoint does not come close to tapping the potential of the computer as a learning tool
- Focus on real world applications of computers that enhance learning, an example would be the presentation shown to us of students maintaining a financial balance sheet for investing in stocks. Or introduce some programming techniques and apply it to math or science. Or maintain a class bulletin board or web site. Or develop class file maintenance practices. Or communicate or explore other cultures or subject areas together as a class on the internet. None of these types of interesting projects have been introduced in my son's classes. His friends are left with interesting wall paper and filling up the hard drive with games.
- I would like to see all teachers use the mygradebook system. It is an excellent way to "check" on your child's progress
- The teacher's don't appear to have any guidance or requirements from the school district when it come to the laptop program. They seem to do whatever they want. This was a very large investment to teach my son how to type!

- Have the teachers post the assignments on line--have each class/teacher have a web page that parents can access to find out what is happening. As kids get older, we see less and less communications from school.
 - I would like to see more equity in the amount of time each team spends using the laptop. Some teams appear to use the laptop almost exclusively while others appear to have a more hit or miss approach.
 - Kids should have access to locking their computers in a secure, safe area in school -- so they don't have to unnecessarily transport them back and forth to school
 - Have it supplement the test book learning instead of replace it.
 - There should be more guidance from the school district. The success of the program for the students shouldn't just be with the teachers who volunteer to take on the laptop kids just to lighten their own workload.
 - Use in the high schools when the students are more responsible.
-

A summary of the final open-ended item which asked laptop parents if they had any additional comments can be seen in Table 18.4. Nearly half (45%) of the 33 responses positively supported the laptop program. An additional 7 indicated that the program should be made available to all students, while four reiterated their concerns with the laptops and affiliated support. There were a couple of parents who wanted the parents to be more involved and a couple who expressed concerns with the overall value of the program.

Table 18.4

Laptop Parent Survey: Summary of Open-Ended Comments (n = 66)

Question: Any other comments?

Response Categories	Number of Responses	Percent of Total Responses
Good program/learning tool	15	45%
Make program available to all	7	21%
Problems with computer and computer support	4	12%
More parental involvement needed	2	6%
Not sure program is beneficial	2	6%
Decrease student use of games	1	3%
Need more feedback from Walled Lake	1	3%
Handwriting/spelling skills have decreased	1	3%
TOTAL	33	100%

Sample Responses

Any other comments?

- This has been a great program. I feel that its essential for the future success of our kids to be given every opportunity to succeed in life, this program has provided that first step.
- I love this program my child has increased his ability to communicate and is very self-assured about his home work and is getting great marks.
- An excellent program, a real advantage for the children in the program and the teachers seem really motivated
- Please keep the project going!!!
- The program was left undeveloped in my opinion, a lost opportunity. Any parental involvement was dropped. An underestimated expectation of the sophistication of students and an overestimation of teacher's ability to maximize the educational opportunity....expensive.
- I want feedback from Walled Lake School District and more communication as to where this program is headed.
- We will stick with the program 1 more year but will re-evaluate her participation. I am not convinced that laptops in school every class hour help students to learn much better.
- Again, [my child's teacher] is the only one I feel who really makes the kids excel in using their laptop.
- I don't feel that they have gained any knowledge that they could not have gotten from a computer class at school.
- What the plan is for entering high school for the kids that have been in the lap top program for 3 years?

CE parents. A total of 30 parents responded to the computer survey, which as mentioned earlier represents approximately 25% of the 134 who were asked to complete the survey. The grade levels of their children represented in the sample were 13% 5th grade, 73% 6th grade, and 13% 7th grade. About 3% of the parents indicated that their child was in special education, and 3% indicated that their child was an English-as-Second-Language (ESL) students. The majority of respondents were parents of male students (60%). A summary of

the survey results is provided on Table 18. The description of results below will highlight key findings and draw contrasts with responses on similar items from Laptop parents. Also, significant effects from chi-square tests of independence on the similar items will be noted.

Table 19

Summary of the Descriptive Statistics for Enhanced Parent Survey (n = 30)

	Never	Rarely or Occasionally	1-2 days per week	3-4 days per week	Every day
Please answer the following questions if you have a computer in your home					
About how often does your child do school work with the computer at home?	6.9%	13.8%	41.4%	20.7%	17.2%
How frequently does your child use the computer for things other than homework?	10.7%	7.1%	17.9%	25.0%	39.3%
Home Computers					
	1	2	3	4	
How many computers do you have in your home?	44.8%	27.6%	20.7%	6.9%	
Type?			PC	Mac	
			100.0%	0.0%	
Printer?			Yes	No	
			100.0%	0.0%	
The Internet					
Can you access the internet with a home computer?				100.0%	0.0%
	Never	Rarely or Occasionally	1-2 days per week	3-4 days per week	Every day
If yes, how often does your child use the internet for schoolwork?	13.3%	30.0%	26.7%	30.0%	0.0%
If yes, how often does he/she use the internet for things other than schoolwork?	3.4%	13.8%	27.6%	27.6%	27.6%
How frequently do you or other family members use the internet for things other than your child's schoolwork?	3.3%	3.3%	10.0%	23.3%	60.0%
	NA	Reduced	Same	Increased	
Does the laptop help?					
To what degree has the laptop computer changed your child's:					
interest in school?	6.7%			30.0%	50.0%
achievement in school?*	6.7%	3.3%		63.3%	26.7%
involvement in project-type school work?					
writing skills?**	6.9%	3.4%		69.0%	20.7%
research skills?	6.7%	0.0%		13.3%	80.0%
ability to work with other students?	6.7%	0.0%		66.7%	26.7%
The Laptop and Your Family					
To what degree has the laptop computer changed your or another adult's:					
involvement with your child's school work?	6.7%	6.7%		70.0%	16.7%
interactions with your child?	3.3%	0.0%		83.3%	13.3%
interactions with your child's teacher?	13.3%	3.3%		66.7%	16.7%
communications with other parents?	20.0%	0.0%		66.7%	13.3%
To what degree has the laptop computer changed your:					
involvement with projects your child does in school?	3.6%	7.1%		60.7%	28.6%
your assistance with homework?	3.3%	20.0%		70.0%	6.7%

Table 19

Summary of the Descriptive Statistics for Enhanced Parent Survey (n = 30) (continued)

To what degree has the laptop computer changed other children's:				
involvement with their brother's or sister's schoolwork?	36.7%	10.0%	40.0%	13.3%
interactions with their brother or sister?	36.7%	6.7%	33.3%	23.3%
use of the laptop for their schoolwork?	43.3%	6.7%	30.0%	20.0%
Positive interactions between each other?	34.5%	6.9%	48.3%	10.3%
		Yes	No	NA
Has your child helped you with a project this year?		34.5%	58.6%	6.9%
Have you learned something about computers from your child this year?		36.7%	60.0%	3.3%

p<.05, **p<.01, *p<.001*

Close to 40% of the CE parents (compared to 55% of the Laptop parents) indicated that their child used a computer at home for schoolwork at least 3 to 4 days per week. However, a slightly greater percentage of CE (64%) than Laptop (57%) parents indicated that the child used the computer at home at least 3 to 4 days per week for activities other than homework. Nearly all homes had at least one other computer, all of which were PCs and connected to a printer.

All of CE parents (compared to 64% of the Laptop sample) indicated that they could access the internet. Similar to the Laptop parents, the majority believed that their child used the internet for both schoolwork and other activities at least 1 to 2 days a week. Close to two-thirds (60%, compared to 53% for Laptop) of the respondents believed that they or family members used the internet every day for activities unrelated to schoolwork.

Benefits attributed to the program by over 50% of the respondents were improvements in their child's interest in school (58%), involvement in projects (60%), and research skills (80%). Only 20% (versus 57% for Laptop) believed that improvement in writing skills was attributable to computer usage, while only 27% (versus 49% for Laptop)

believed that improvement in achievement occurred. These two items were the only ones showing significant differences between the two groups. Similar to the Laptop sample, the CE parents saw little influence of the child's computer activities in increasing the parents' involvement with the school or sibling interactions at home. About one-third of the CE parents, compared to none of the Laptop parents, indicated that the child helped them with a project or helped them learn more about computers.

Two open-ended responses were similar for both the CE (see Table 20.1) and Laptop parents regarding the best aspect of the school computer program or the laptop program. For both groups the most common response was that their children were learning technology skills (35% CE; 37% Laptop). The second common response was that use of computers had increased general learning skills (29% CE; 31% Laptop). The CE parents also commented that the best aspect was improved ability to use the internet (29%) and improved quality of work due to word processing (12%).

Table 20.1

CE Parent Survey: Summary of Open-Ended Comments (n = 30)

Question: What is the best thing about having school computers available for your son/daughter?

Response Categories	Number of Responses	Percent of Total Responses
Learning technology/office applications	6	35%
Internet/Research capabilities	5	29%
General learning skills	4	24%
Better quality of work	2	12%
TOTAL	17	100%

Sample Responses

What is the best thing about having school computers available for your son/daughter?

- His work is neater and more organized.
- Increased computer knowledge.
- Familiarity with the computer as a tool. Proficiency in applications like MS Word, PP.
- Having internet access readily available and knowing their getting knowledge about computers
- Improved technical skills.
- The best thing about having a computer available for my children is very helpful when it come to doing school research.
- Increase his learning skills.
- Typing speeds improved

There were a total of 11 responses concerning the worst thing about school computers being available for their son or daughter (see Table 20.2). Both the CE and Laptop parents expressed concerns over two common areas: wasting time on the internet and/or playing games (36% CE; 13% Laptop) and not being as capable with tasks such as spelling or handwriting due to the use of spell check and word processing (18% CE; 8% Laptop). Both groups had responses that stated there were no “worst” aspects of the computer programs (27% CE; 11% Laptop), while a couple of CE responses expressed concern over students accessing inappropriate content while on the web.

Table 20.2

CE Parent Survey: Summary of Open-Ended Comments (n = 30)

Question: What is the worst thing about having school computers available for your son/daughter?

Response Categories	Number of Responses	Percent of Total Responses
Waste time on surfing or games	4	36%
None	3	27%
Not doing things for themselves	2	18%
Access to Inappropriate sites	2	18%
TOTAL	11	100%

Sample Responses

What is the worst thing about having school computers available for your son/daughter?

- Tendency to waste time surfing or playing games.
- Sometimes they use them for long periods of time, which I do not like, unless used for school work.
- I can't think of anything bad.
- Concerns about spelling.
- I feel more emphasis needs to be made on the children's penmanship
- Accidental access to information that's not intended for them to see at early ages

The CE parents were also asked how the computer program at school could be improved. As seen in Table 20.3, six responses were given, with four indicating that the school computer program did not need to be changed, one indicating that the computers should be used more often, and one expressing that students should receive more basic computer training. There were no responses when asked if they had “Any other comments?”

Table 20.3

CE Parent Survey: Summary of Open-Ended Comments (n = 30)

Question: What changes would you like to see in the school computer program?

Response Categories	Number of Responses	Percent of Total Responses
Nothing	4	67%
More practice	1	17%
More training with computers	1	17%
TOTAL	6	100%

Sample Responses

What changes would you like to see in the school computer program?

- More everyday use.
- Learn more about basic programs.
- I'm not too familiar with the schools computer system. But I do agree its helped my son achieve better grades with the help of his teachers.
- Very positive program!
- I can not think of anything I would change at this time.
- Nothing

DISCUSSION

Results of this study suggest varied impacts of the Laptop Program on students, teachers, and family members. These findings are discussed below in reference to the three primary research questions.

IS TEACHING DIFFERENT IN A LAPTOP CLASSROOM?

In the Year 1 evaluation, Laptop classes were compared to Control classes that did *not* have extraordinary access to computers (Ross, Morrison, Lowther, & Plants, 2000). Results indicated greater uses in the Laptop classes of student-centered teaching strategies, such as project-based learning independent inquiry/research, teacher as coach/facilitator, and cooperative learning. Overall, the Laptop classes were “busier” and more active learning environments. Most revealing in the study was the Laptop students’ superiority in using computer as a learning tool.

In contrast, the present study revealed relatively few differences in teaching methods between Laptop and CE classes. Objectively, the most obvious explanation of the discrepancies is that the present sample of Laptop classes tended to use student-centered teaching approaches less frequently than did the Year 1 group. A clear difference, for example, was in cooperative learning, which was observed in 65% of the Year 1 Laptop visits as compared to only 22% of the Year 2 Laptop visits. While the present (Year 2) Laptop classes were certainly busy and active places compared to typical classrooms that we have observed (Ross, Smith, Alberg, & Lowther, 2000) perhaps the teachers were less influenced by a “Hawthorne-type” effect than in Year 1, and thus were less likely to demonstrate “model” lessons. Some may have felt more confident about intermixing traditional practices

to ensure that state content standards were being addressed. CE classrooms, however, were generally comparable to the Control classrooms of the first year.

Consistent across both years of the study was the Laptop students' more frequent usage of the computer as a learning tool. Specifically, such applications were observed in 66% of the visits to Laptop classes compared to only 17% of the CE classes, a highly significant difference. The SCU findings further revealed greater use of word-processing and CD referencing in the Laptop classes and "more meaningful" overall usage of the computer (statistically significant in 6th grade only). These results were not as striking as in the first year, but especially in view of CE classes also having NTeQ-trained teachers and enhanced technology resources, they still indicate positive impacts of the Laptop program for infusing technology use into teaching practices.

DO STUDENTS BEHAVE DIFFERENTLY IN A LAPTOP CLASSROOM?

Compared to their "Control" counterparts in Study I, the Laptop students were more active, autonomous, and collaborative in their classroom behaviors. In the present study, the Laptop and CE students behaved fairly comparably, except that Laptop students tended to use computers more frequently, extensively, and independently. This impression was reinforced by results on all measures (e.g., *SOM*[®], *SCU*[®], teacher survey, student survey). Although not statistically significant, comparisons between the two groups on the *SOM*[®] item concerning student attention and engagement reflected directionally higher ratings for Laptop (62% "high") than CE (44%) classes.

DO STUDENTS ACHIEVE DIFFERENTLY IN A LAPTOP CLASSROOM?

Two measures of achievement—a writing prompt and problem-solving task—were administered in this study to assess achievement. In Study I, the writing prompt alone was

used in the 6th grade only. The Laptop group surpassed the Control group on all evaluation components—Ideas and Content, Organization, Style, and Conventions. The effects obtained reflected relatively strong advantages for the Laptop group, with effect sizes ranging from +0.61 to +0.78. In the present study, the writing assessment included both the 6th and 7th grades. Results showed substantial advantages for Laptop over CE students. Six of the eight effect sizes (4 components x 2 grades) exceeded +.80, while the mean differences in many cases approximated or exceeded a full rubric point. Clearly, the Laptop students were demonstrating superior writing skills.

Although the SOM data did not reveal significant differences in sustained writing activities in Laptop vs. CE classrooms, SCU data did reveal significant differences in the use of word processing. The Laptop students frequently or extensively used word processing in over half (54%) of the classroom visits, whereas use of word processing was only observed in 16% of the visits to CE classes. In their survey responses, nearly 75% of the Laptop students and 100% of the teachers felt that use of the laptop had improved their writing. Fewer, but still a majority (57%) of the Laptop parents also concurred that the program engendered improved writing skills. As seen in the open-ended comments on the Student Survey, more than half of the Laptop students indicated that the best thing about having the computer was that it made school work, or primarily writing, easier. These thoughts are reflected in the following comments from Laptop students:

- The best thing about having a laptop is that it's so much easier than like doing a writing assignment on paper because if you "mess up" on paper you have to erase the whole thing but on a laptop it's easier to just move paragraphs around
- With the laptop I don't have to worry about my handwriting.
- ...when you write things by hand it takes a lot longer so...computers make things a lot easier.

Results on the problem-solving test were further suggestive of the Laptop program's positive impacts on student achievement. These differences may have been influenced by Laptop students' engagement in research activities, as evidenced in teacher and student survey responses. The teachers who completed the survey had overall agreement that the laptop program had increased student research skills. They also indicated that they integrate computer tools that support research activities, such as word processing, internet, and presentation into their coursework.

Student Survey responses revealed significant differences between Laptop and CE students level of confidence to use all the basic software applications. Responses also indicated that 95% of the Laptop students felt confident to conduct internet searches. As revealed in the following selection of comments, engagement in research activities was often perceived as one of the best aspects of the Laptop program.

- It opens up a whole variety of resources
- I like Excel which is very useful for organizing and creating graphs for science and math
- The best thing is being able to find information really fast and use it in class for projects.
- It helps you to be organized
- It makes it easier to do research projects and write essays

Research- and project-oriented tasks would seem likely to enhance students' performance in the types of problem-solving skills assessed in this study (e.g., understanding a problem, identifying what is needed to solve it, using technology). In this respect, Laptop students had two seemingly important advantages over their CE counterparts. One was that their teachers placed greater emphasis on such tasks than did the CE teachers. Second, Laptop students had greater accessibility to and better skills at using application software geared to solving open-ended learning problems (i.e., arranging data, obtaining information, presenting

results, etc.). This combination of factors conceivably increased their range for planning and conceptualizing how a new, complex problem could be approached and systematically solved. Given the quasi-experimental nature of the research design, using pre-established groups, these interpretations can only be speculative at this point. Further research is needed to demonstrate similar findings with other student groups.

CONCLUSIONS

In this evaluation of the second year of the Laptop Program, the results are supportive of beneficial impacts of the Laptop program on students, teachers, and parents. As in the Year 1 study, all three groups believed that the program was positively changing teaching and learning both at school and at home. Although the results were less striking this year, the reasons seem largely due to (a) CE teachers being more oriented and trained to use computers than were the “control” teachers from Year 1, and (b) the scale-up of the Laptop program to more teachers and classes. Observers this year seemed more likely to see “typical” lessons focusing on state objectives and curricula than “model” lessons to demonstrate exemplary Laptop applications. Still, there was no question that the Laptop students were far superior to CE students in their computers skills and usage of technology for learning. Laptop classes were the clear “cause” of these advantages.

Clearly, more research is needed on how the Laptop Program impacts student achievement. Even though pre-formed groups were used in the present study, the positive results from the writing and problem-solving assessments are nonetheless highly suggestive. Laptop students were doing more sustained writing in class and were demonstrating more skill in writing, making a causal connection highly likely. Control classes could also increase their emphasis on writing, but it is obvious that continual and immediate access to computers

provides the Laptop students and their teachers with a very strong advantage. Similarly, Laptop students had greater opportunity to engage in open-ended learning tasks that emphasized problem solving, and to use a variety of software tools to increase the speed and depth of their work. Laptop students are much more fluent than other students with using the technology of the 21st Century for learning, research, and production.

Given the above conclusion, we should note a possible concern that acquired greater saliency in this year's results. First, it is noteworthy that having to carry the computer to and from school was viewed by both Laptop students and their parents as the most significant negative aspect of the program. Yet, students and parents reported only a moderate amount of school-related computer use at home. Equipment problems (with extended waits for repair) seemed to be exacerbated by all of the transporting of computers. Second, there was noticeably increased dissatisfaction by students and parents with the exclusionary nature of the program. Those not selected for financial or other reasons would miss out on the benefits of technology-immersed classroom learning. Perhaps the finding of greatest importance from the past two years is that full access to computers in the classroom, whether or not there is access at home, is what drives curriculum and learning most substantively. Further study of stakeholder reactions, school policies, and resource constraints is suggested to determine whether reorientation of the Laptop concept to make classroom computer use available to all students might yield the highest overall satisfaction and results.

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Appendix A
School Observation Measure (SOM[®])
Data Summary Form

Appendix B
Survey of Computer Use (SCU®)
Data Summary Form

Appendix C

Writing Rubric

Writing Scoring Guide

	Mature (4)	Capable (3)	Developing (2)	Emerging (1)
Ideas and Content	Central idea is clear and focused. Writer uses creative, insightful detail.	Central idea is clear and focused and the writer adds basic detail.	Central idea is somewhat developed, and the writer includes some detail; however, focus may shift and some details are extraneous.	Writing may show little or no development of the central idea or may be too limited in length to demonstrate proficiency
Organization	Organization helps unify the piece and moves the reader easily through the text.	Organization is apparent but may be too obviously structured; may be extraneous detail which interferes with unity.	An attempt at organization is apparent although ideas may lack a sense of wholeness	Organization may be lacking; or may seem arbitrary.
Style	Voice of writer comes through with rich and precise word choice and effective use of varied sentence structure.	Writing demonstrates varied sentence structure as well as appropriate word choices, including some engaging vocabulary.	Vocabulary is limited or inappropriate to the task; sentence structure may be simple.	Vocabulary is limited; sentences may be choppy, incomplete or rambling
Conventions	Text demonstrates varied use of standard writing conventions with few errors.	Surface feature errors may occasionally distract the reader, but they don't interfere with understanding.	Surface feature errors make understanding difficult.	Numerous surface feature errors may severely interfere with understanding.

Appendix D
Problem-Solving Task

Problem-Solving: Letter to Teachers

Dear Teacher:

As part of this year's Anytime Anywhere Learning project, we have developed a problem-solving task for sixth grade students. We have selected your classroom to complete this task. The following are the directions.

Directions and Information

1. Students are tell us *how* they will solve the problem rather than solving it.
2. Please allow the students to enter their answers on a computer so that all are word-processed.
3. Students should not put their name or any other identifying mark on their paper.
4. Please read the attached announcement before the students start working on the task.
5. Allow 45 minutes to complete the task.

Please read to class before distributing the problem solving task:

A group of Wayne State University researchers are working with our school district to find out the best way to use computers in your classroom. They are asking you to tell them how you would solve a problem.

Whether you participate or not is, of course, up to you. What you tell them will be kept secret. They will not tell your teacher, principal, or parents what you have said. They might mention what some of the students have said in one of their reports, but they will not mention your name.

In any case, you should still remember that if there's any question that you do not want to answer, that's ok.

Appendix E
Problem-Solving Rubric

Problem-Solving Rubric

Component/Rating	Level 1	Level 2	Level 3
Understands problem	The overall problem-solving approach demonstrates a very limited understanding of the problem.	The overall problem-solving approach somewhat demonstrates a general understanding of the problem.	The overall problem-solving approach strongly demonstrates clear understanding of the problem.
Identifies what is known about the problem	Provides a very limited or no description of what is known.	Provides an incomplete description of what is known	Provides a complete and detailed list of what is known about problem
Identifies what needs to be known to solve the problem	Provides no or a very limited relationship between data/what needs to be known and problem	Provides some reasoning as to how data/what needs to be known are related to problem-solving	Provides developed rationale as to how data/what needs to be known are related to solving the problem
Determines how the data needs to be manipulated to solve the problem	Does not address data manipulation	Provides indication that data must be manipulated	Describes specific ways of manipulating data to solve problem
Describes use of technology	Description of technology use is not included or very limited, e.g., the computer will be used to get information.	Describes specific technology/software that will be used to solve problem, but only provides general tasks to be completed, e.g., the Internet will be used to find information.	Describes specific technology/software and specific tasks that will be used to solve problem, e.g., the Internet will be used to find information about recycling paper.
Describes how to present findings	Provides no or very limited detail as to how results will be presented	Provides a general description of how results will be presented	Describes details of how and what results will be presented
Collaborative Learning	No mention of collaboration or independent orientation	Describes limited collaboration, mostly for sharing information or obtaining help	Describes a collaborative orientation with assigned responsibilities and extensive interactions with partners

Appendix F
Student Focus Group

Anytime, Anywhere Learning
STUDENT FOCUS GROUP

I. Overall Impressions

- Overall, how has it been to have a laptop computer for school this year?
- What has been the best part of having the laptop?
- What has been the worst part of having the laptop?

II. Classroom Level Changes

How has having laptops changed what happens in the classroom? Specifically, can you give examples of the following:

1. Have you worked on more projects? If yes, briefly tell me about the best one.
2. Have your assignments been more involved and required more thinking... In what way?
3. Have you done more research? If yes, what resources did you use?
4. Have you been required to do more writing? Tell me about some things you've written.
5. Do you work in small groups of students more this year? How do you feel about that?
6. Are you keeping a portfolio of your work? Do you or your teacher use rubrics to "grade" your work? Do you ever have task lists to help you know what to do?

III. Student Results

- Can you describe how having the laptop computer has impacted your learning or your grades?
- Has having the laptop computer impacted your relationship with other students? How?
- Has having the laptop computer changed how students and teachers relate to each other. In what ways?
- Can you describe how having a laptop computer has made you feel about going to school or participating in class activities?

V. Parent Support

How do your parents feel about you having a laptop computer?

How do other family members feel about your having the laptop?

Have there been any changes in how often your parents visit with or talk to your teacher or the principal now that you have the laptop? If yes, what do they talk about?

Other Comments:

Appendix G
Teacher Interview

Technology as a Tool for Learning
TEACHER FOCUS GROUP/INTERVIEWS

I. Overall Impressions

- How is the implementation of the Laptop Project going this year?
- What are the most effective aspects of the Laptop Project?
- What are the most difficult aspects of this project?

II. Classroom Level Changes

How has the laptop project impacted classroom practices? Specifically, are there differences in:

1. Interdisciplinary and project-based learning
2. Higher-level learning in my classroom instruction
3. Development of research skills
4. Development of writing skills
5. Cooperative and team-based approaches
6. Authentic, alternative assessment

III. Student Results

- How has the Laptop Project impacted students?
- How has the Laptop Project fostered relationships between students and between students and teachers.
- Are there differences in achievement?
- Can you describe any differences in student motivation or enthusiasm?

III. Impact on Teachers

- How has the Laptop Project impacted teachers?
- How has the Laptop Project impacted relationships between teachers?

V. Parent Support

- How would you describe parent support for the Laptop Project?
- How has school-related interactions and communication with students and parents been impacted as a result of students having the laptop computers?

Other Comments:

Appendix H
SOM Tables H.1 to H.3

Table H.1

Proportion of times an event was observed (1-4) versus not observed (0) for Laptop and Computer-Extended classes (Grade 5)

Strategies	Laptop (n=8)		Computer Extended (n=10)	
	Observed	Not Observed	Observed	Not Observed
Direct instruction	75.0	25.0	80.0	20.0
Team teaching	0.0	100.0	0.0	100.0
Cooperative/collaborative learning	12.5	87.5	10.0	90.0
Individual tutoring	0.0	100.0	0.0	100.0
Ability groups	0.0	100.0	0.0	100.0
Multi-age grouping	0.0	100.0	0.0	100.0
Work centers	0.0	100.0	20.0	80.0
Higher level instructional feedback	62.5	37.5	40.0	60.0
Integration of subject areas*	0.0	100.0	40.0	60.0
Project-based learning	25.0	75.0	30.0	70.0
Use of higher-level questioning	37.5	62.5	60.0	40.0
Teacher as a coach/facilitator	62.5	37.5	50.0	50.0
Parent/community involvement	0.0	100.0	10.0	90.0
Independent seatwork	37.5	62.5	60.0	40.0
Experiential, hands on learning	12.5	87.5	10.0	90.0
Systematic individual instruction	0.0	100.0	0.0	100.0
Sustained writing/composition	62.5	37.5	30.0	70.0
Sustained reading	0.0	100.0	30.0	70.0
Independent inquiry/research	37.5	62.5	20.0	80.0
Student discussion	0.0	100.0	20.0	80.0
Computer for instructional delivery	12.5	87.5	10.0	90.0
Technology as a learning tool**	62.5	37.5	10.0	90.0
Performance assessment	12.5	87.5	30.0	70.0
Student self-assessment	25.0	75.0	20.0	80.0

* $p < .05$, ** $p < .01$, *** $p < .001$

Table H.2

Proportion of times an event was observed (1-4) versus not observed (0) for Laptop and Computer-Extended classes (Grade 6)

Strategies	Laptop (n=17)		Computer Extended (n=6)	
	Observed	Not Observed	Observed	Not Observed
Direct instruction	64.7	35.3	33.3	66.7
Team teaching	0.0	100.0	0.0	100.0
Cooperative/collaborative learning	29.4	70.6	16.7	83.3
Individual tutoring	5.9	94.1	16.7	83.3
Ability groups	0.0	100.0	0.0	100.0
Multi-age grouping	0.0	100.0	16.7	83.3
Work centers	0.0	100.0	0.0	100.0
Higher level instructional feedback	41.2	58.8	16.7	83.3
Integration of subject areas*	11.8	88.2	50.0	50.0
Project-based learning	25.0	75.0	16.7	83.3
Use of higher-level questioning	58.8	41.2	50.0	50.0
Teacher as a coach/facilitator	47.1	52.9	50.0	50.0
Parent/community involvement	0.0	100.0	0.0	100.0
Independent seatwork	35.3	64.7	50.0	50.0
Experiential, hands on learning*	11.8	88.2	50.0	50.0
Systematic individual instruction	5.9	94.1	16.7	83.3
Sustained writing/composition	29.4	70.6	50.0	50.0
Sustained reading	17.6	82.4	33.3	66.7
Independent inquiry/research	35.3	64.7	16.7	83.3
Student discussion	35.3	64.7	16.7	83.3
Computer for instructional delivery	11.8	88.2	0.0	100.0
Technology as a learning tool**	58.8	41.2	0.0	100.0
Performance assessment	11.8	88.2	16.7	83.3
Student self-assessment	17.6	82.4	16.7	83.3

* $p < .05$, ** $p < .01$, *** $p < .001$

Table H.3

Proportion of times an event was observed (1-4) versus not observed (0) for Laptop and Computer-Extended classes (Grade 7)

Strategies	Laptop (n=7)		Computer Extended (n=7)	
	Observed	Not Observed	Observed	Not Observed
Direct instruction	71.4	28.6	57.1	42.9
Team teaching	0.0	100.0	14.3	85.7
Cooperative/collaborative learning	14.3	85.7	28.6	71.4
Individual tutoring	0.0	100.0	14.3	85.7
Ability groups	0.0	100.0	0.0	100.0
Multi-age grouping	0.0	100.0	0.0	100.0
Work centers	0.0	100.0	0.0	100.0
Higher level instructional feedback	14.3	85.7	42.9	57.1
Integration of subject areas*	0.0	100.0	57.1	42.9
Project-based learning	14.3	85.7	42.9	57.1
Use of higher-level questioning	42.9	57.1	42.9	57.1
Teacher as a coach/facilitator	71.4	28.6	57.1	42.9
Parent/community involvement	0.0	100.0	0.0	100.0
Independent seatwork	57.1	42.9	71.4	28.6
Experiential, hands on learning	28.6	71.4	0.0	100.0
Systematic individual instruction	0.0	100.0	14.3	85.7
Sustained writing/composition	14.3	85.7	42.9	57.1
Sustained reading	14.3	85.7	14.3	85.7
Independent inquiry/research	42.9	57.1	28.6	71.4
Student discussion	14.3	85.7	42.9	57.1
Computer for instructional delivery	14.3	85.7	0.0	100.0
Technology as a learning tool	85.7	14.3	42.9	57.1
Performance assessment	0.0	100.0	28.6	71.4
Student self-assessment	0.0	100.0	0.0	100.0

* $p < .05$, ** $p < .01$, *** $p < .001$

Appendix I
SCU Tables I.1 to I.3

Table I.1

Survey of Computer Use Data Summary for Laptop vs. Computer Extended for 5th Grade

Computer Capacity and Currency						
Group		None	Few	Some	Most	All
Laptop	Classrooms with 1 computer	100.0%	0.0%	0.0%	0.0%	0.0%
	Classrooms with 2 - 4 computers	87.5%	0.0%	0.0%	0.0%	12.5%
	Classrooms with 5 or more computers	12.5%	0.0%	0.0%	0.0%	87.5%
	Computers that were:					
	outdated and limited in capacity	100.0%	0.0%	0.0%	0.0%	0.0%
	aging but adequate	100.0%	0.0%	0.0%	0.0%	0.0%
	up-to-date	100.0%	0.0%	0.0%	0.0%	0.0%
	Computers with internet access	100.0%	0.0%	0.0%	0.0%	0.0%
Computer Extended	Classrooms with 1 computer	100.0%	0.0%	0.0%	0.0%	0.0%
	Classrooms with 2 - 4 computers	50.0%	0.0%	0.0%	0.0%	50.0%
	Classrooms with 5 or more computers	50.0%	0.0%	0.0%	0.0%	50.0%
	Computers that were:					
	outdated and limited in capacity	100.0%	0.0%	0.0%	0.0%	0.0%
	aging but adequate	100.0%	0.0%	0.0%	0.0%	0.0%
	up-to-date	100.0%	0.0%	0.0%	0.0%	0.0%
	Computers with internet access	100.0%	0.0%	0.0%	0.0%	0.0%
Extent of Computer Use						
Group		None	Few	Some	Most	All
Laptop	Computers used by					
	nearly all (91-100%) students	50.0%	0.0%	0.0%	0.0%	50.0%
	most (about 51-90%) students	75.0%	0.0%	0.0%	0.0%	25.0%
	some (about 10-50%) students	100.0%	0.0%	0.0%	0.0%	0.0%
	few (less than 10%) students	75.0%	0.0%	0.0%	0.0%	25.0%
Computer Extended	Computers used by					
	nearly all (91-100%) students	100.0%	0.0%	0.0%	0.0%	0.0%
	most (about 51-90%) students	100.0%	0.0%	0.0%	0.0%	0.0%
	some (about 10-50%) students	87.5%	0.0%	0.0%	12.5%	0.0%
	few (less than 10%) students	75.0%	0.0%	0.0%	0.0%	25.0%

Table I.1

Survey of Computer Use Data Summary for Laptop vs. Computer Extended for 5th Grade (continued)

Computer Configuration		Not Observed	Rarely	Occasionally	Frequently	Extensively
Group						
Laptop	Students worked:					
	alone at the computer	25.0%	0.0%	12.5%	0.0%	62.5%
	in pairs at the computer	87.5%	12.5%	0.0%	0.0%	0.0%
	in small groups at the computer	100.0%	0.0%	0.0%	0.0%	0.0%
	Students were computer literate	25.0%	0.0%	0.0%	0.0%	75.0%
	Students easily used the keyboard	25.0%	0.0%	0.0%	0.0%	75.0%
Computer Extended	Students worked alone at the computer	75.0%	0.0%	12.5%	0.0%	12.5%
	Students worked in pairs at the computer	100.0%	0.0%	0.0%	0.0%	0.0%
	Students worked in small groups at the computer	100.0%	0.0%	0.0%	0.0%	0.0%
	Students were computer literate	75.0%	0.0%	12.5%	12.5%	0.0%
	Students easily used the keyboard	75.0%	0.0%	12.5%	12.5%	0.0%
Production Tools Used by Students		Not Observed	Rarely	Occasionally	Frequently	Extensively
Group						
Laptop	Word Processing	37.5%	0.0%	0.0%	12.5%	50.0%
	Database	100.0%	0.0%	0.0%	0.0%	0.0%
	Spreadsheet	100.0%	0.0%	0.0%	0.0%	0.0%
	Draw/Paint/Graphics	87.5%	12.5%	0.0%	0.0%	0.0%
	Presentation (e.g., MS PowerPoint)	100.0%	0.0%	0.0%	0.0%	0.0%
	Authoring (e.g., HyperStudio)	100.0%	0.0%	0.0%	0.0%	0.0%
	Concept Mapping(e.g., Inspiration)	100.0%	0.0%	0.0%	0.0%	0.0%
	Planning (e.g., MS Project)	100.0%	0.0%	0.0%	0.0%	0.0%
Computer Extended	Word Processing	75.0%	0.0%	25.0%	0.0%	0.0%
	Database	100.0%	0.0%	0.0%	0.0%	0.0%
	Spreadsheet	100.0%	0.0%	0.0%	0.0%	0.0%
	Draw/Paint/Graphics	100.0%	0.0%	0.0%	0.0%	0.0%
	Presentation (e.g., MS PowerPoint)	100.0%	0.0%	0.0%	0.0%	0.0%
	Authoring (e.g., HyperStudio)	100.0%	0.0%	0.0%	0.0%	0.0%
	Concept Mapping(e.g., Inspiration)	100.0%	0.0%	0.0%	0.0%	0.0%
	Planning (e.g., MS Project)	100.0%	0.0%	0.0%	0.0%	0.0%

Table I.1

Survey of Computer Use Data Summary for Laptop vs. Computer Extended for 5th Grade (continued)

Internet/Research Tools Used by Students						
Group		Not Observed	Rarely	Occasionally	Frequently	Extensively
Laptop	Internet Browser (e.g., Netscape)	57.1%	0.0%	7.1%	7.1%	28.6%
	CD Reference (encyclopedias, etc.)	71.4%	7.1%	7.1%	7.1%	7.1%
	Communications	92.9%	7.1%	0.0%	0.0%	0.0%
Computer Extended	Internet Browser (e.g., Netscape)	100.0%	0.0%	0.0%	0.0%	0.0%
	CD Reference (encyclopedias, etc.)	100.0%	0.0%	0.0%	0.0%	0.0%
	Communications	100.0%	0.0%	0.0%	0.0%	0.0%
Educational Software Used by Students						
Group		Not Observed	Rarely	Occasionally	Frequently	Extensively
Laptop	Drill/Practice/Tutorial	100.0%	0.0%	0.0%	0.0%	0.0%
	Problem Solving (Oregon Trail, SimCity, etc.)	100.0%	0.0%	0.0%	0.0%	0.0%
	Process Tools (Geometer's Sketchpad, etc.)	100.0%	0.0%	0.0%	0.0%	0.0%
Computer Extended	Drill/Practice/Tutorial	87.5%	0.0%	0.0%	12.5%	0.0%
	Problem Solving (Oregon Trail, SimCity, etc.)	100.0%	0.0%	0.0%	0.0%	0.0%
	Process Tools (Geometer's Sketchpad, etc.)	100.0%	0.0%	0.0%	0.0%	0.0%
Subject Areas of Computer Activities						
Group		Other	Language Arts	Mathematics	Science	Social Science
Laptop	Production Tools	0.0%	100.0%	0.0%	0.0%	0.0%
	Internet/Research Tools	0.0%	100.0%	0.0%	0.0%	0.0%
	Educational Software	0.0%	0.0%	0.0%	0.0%	0.0%
Computer Extended	Production Tools	100.0%	0.0%	0.0%	0.0%	0.0%
	Internet/Research Tools	75.0%	0.0%	0.0%	0.0%	25.0%
	Educational Software	75.0%	0.0%	25.0%	0.0%	0.0%

Table I.2

Survey of Computer Use Data Summary for Laptop vs. Computer Extended for 6th Grade

Computer Capacity and Currency						
Group		None	Few	Some	Most	All
Laptop	Classrooms with 1 computer	100.0%	0.0%	0.0%	0.0%	0.0%
	Classrooms with 2 - 4 computers	88.2%	0.0%	0.0%	11.8%	0.0%
	Classrooms with 5 or more computers	13.3%	6.7%	0.0%	0.0%	80.0%
	Computers that were outdated and limited in capacity	93.3%	6.7%	0.0%	0.0%	0.0%
	Computers that were aging but adequate	93.3%	0.0%	6.7%	0.0%	0.0%
	Computers that were up-to-date	13.3%	0.0%	0.0%	6.7%	80.0%
	Computers with Internet access	13.3%	0.0%	0.0%	0.0%	86.7%
Computer Extended	Classrooms with 1 computer	100.0%	0.0%	0.0%	0.0%	0.0%
	Classrooms with 2 - 4 computers	66.7%	33.3%	0.0%	0.0%	0.0%
	Classrooms with 5 or more computers	75.0%	0.0%	0.0%	0.0%	25.0%
	Computers that were outdated and limited in capacity	100.0%	0.0%	0.0%	0.0%	0.0%
	Computers that were aging but adequate	100.0%	0.0%	0.0%	0.0%	0.0%
	Computers that were up-to-date	50.0%	0.0%	0.0%	0.0%	50.0%
	Computers with internet access	50.0%	0.0%	0.0%	0.0%	50.0%
Extent of Computer Use						
Group		None	Few	Some	Most	All
Laptop	Computers used by					
	nearly all (91-100%) students	28.6%	0.0%	0.0%	0.0%	71.4%
	most (about 51-90%) students	100.0%	0.0%	0.0%	0.0%	0.0%
	some (about 10-50%) students	100.0%	0.0%	0.0%	0.0%	0.0%
	few (less than 10%) students	100.0%	0.0%	0.0%	0.0%	0.0%
Computer Extended	Computers used by					
	nearly all (91-100%) students	75.0%	0.0%	0.0%	0.0%	25.0%
	most (about 51-90%) students	100.0%	0.0%	0.0%	0.0%	0.0%
	some (about 10-50%) students	100.0%	0.0%	0.0%	0.0%	0.0%
	few (less than 10%) students	100.0%	0.0%	0.0%	0.0%	0.0%

Table I.2

Survey of Computer Use Data Summary for Laptop vs. Computer Extended for 6th Grade (continued)

Computer Configuration						
Group		Not Observed	Rarely	Occasionally	Frequently	Extensively
Laptop	Students worked alone at the computer	28.6%	0.0%	7.1%	28.6%	35.7%
	Students worked in pairs at the computer	57.1%	14.3%	14.3%	14.3%	0.0%
	Students worked in small groups at the computer	64.3%	14.3%	21.4%	0.0%	0.0%
	Student were computer literate	28.6%	7.1%	64.3%	0.0%	0.0%
	Students easily used the keyboard	28.6%	0.0%	7.1%	14.3%	50.0%
Computer Extended	Students worked alone at the computer	75.0%	0.0%	25.0%	0.0%	0.0%
	Students worked in pairs at the computer	75.0%	0.0%	25.0%	0.0%	0.0%
	Students worked in small groups at the computer	75.0%	0.0%	25.0%	0.0%	0.0%
	Student were computer literate	75.0%	0.0%	0.0%	0.0%	25.0%
	Students easily used the keyboard	75.0%	0.0%	0.0%	0.0%	25.0%
Production Tools Used by Students						
Group		Not Observed	Rarely	Occasionally	Frequently	Extensively
Laptop	Word Processing	50.0%	7.1%	7.1%	35.7%	0.0%
	Database	92.9%	0.0%	0.0%	0.0%	7.4%
	Spreadsheet	92.9%	0.0%	0.0%	0.0%	7.4%
	Draw/Paint/Graphics	92.9%	0.0%	7.1%	0.0%	0.0%
	Presentation (e.g., MS PowerPoint)	85.7%	0.0%	0.0%	7.1%	7.1%
	Authoring (e.g., HyperStudio)	100.0%	0.0%	0.0%	0.0%	0.0%
	Concept Mapping(e.g., Inspiration)	100.0%	0.0%	0.0%	0.0%	0.0%
	Planning (e.g., MS Project)	100.0%	0.0%	0.0%	0.0%	0.0%
Computer Extended	Word Processing	100.0%	0.0%	0.0%	0.0%	0.0%
	Database	100.0%	0.0%	0.0%	0.0%	0.0%
	Spreadsheet	100.0%	0.0%	0.0%	0.0%	0.0%
	Draw/Paint/Graphics	75.0%	0.0%	0.0%	0.0%	25.0%
	Presentation (e.g., MS PowerPoint)	100.0%	0.0%	0.0%	0.0%	0.0%
	Authoring (e.g., HyperStudio)	100.0%	0.0%	0.0%	0.0%	0.0%
	Concept Mapping(e.g., Inspiration)	100.0%	0.0%	0.0%	0.0%	0.0%
	Planning (e.g., MS Project)	100.0%	0.0%	0.0%	0.0%	0.0%
Internet/Research Tools Used by Students						
Group		Not Observed	Rarely	Occasionally	Frequently	Extensively
Laptop	Internet Browser (e.g., Netscape)	57.1%	0.0%	7.1%	7.1%	28.6%
	CD Reference (encyclopedias, etc.)	71.4%	7.1%	7.1%	7.1%	7.1%
	Communications	92.9%	7.1%	0.0%	0.0%	0.0%
Computer Extended	Internet Browser (e.g., Netscape)	100.0%	0.0%	0.0%	0.0%	0.0%
	CD Reference (encyclopedias, etc.)	100.0%	0.0%	0.0%	0.0%	0.0%
	Communications	100.0%	0.0%	0.0%	0.0%	0.0%

Table I.2

Survey of Computer Use Data Summary for Laptop vs. Computer Extended for 6th Grade (continued)

Educational Software Used by Students						
Group		Not Observed	Rarely	Occasionally	Frequently	Extensively
Laptop	Drill/Practice/Tutorial	100.0%	0.0%	0.0%	0.0%	0.0%
	Problem Solving (Oregon Trail, SimCity, etc.)	100.0%	0.0%	0.0%	0.0%	0.0%
	Process Tools (Geometer's Sketchpad, etc.)	100.0%	0.0%	0.0%	0.0%	0.0%
Computer Extended	Drill/Practice/Tutorial	100.0%	0.0%	0.0%	0.0%	0.0%
	Problem Solving (Oregon Trail, SimCity, etc.)	100.0%	0.0%	0.0%	0.0%	0.0%
	Process Tools (Geometer's Sketchpad, etc.)	100.0%	0.0%	0.0%	0.0%	0.0%
Subject Areas of Computer Activities						
Group		Other	Language Arts	Mathematics	Science	Social Science
Laptop	Production Tools	12.5%	25.0%	0.0%	25.0%	37.5%
	Internet/Research Tools	14.3%	14.3%	0.0%	14.3%	57.1%
	Educational Software	100.0%	0.0%	0.0%	0.0%	0.0%
Computer Extended	Production Tools	100.0%	0.0%	0.0%	0.0%	0.0%
	Internet/Research Tools	100.0%	0.0%	0.0%	0.0%	0.0%
	Educational Software	100.0%	0.0%	0.0%	0.0%	0.0%

Table I.3

Survey of Computer Use Data Summary for Laptop vs. Computer Extended for 7th Grade

Computer Capacity and Currency						
Group		None	Few	Some	Most	All
Laptop	Classrooms with 1 computer	100.0%	0.0%	0.0%	0.0%	0.0%
	Classrooms with 2 - 4 computers	100.0%	0.0%	0.0%	0.0%	0.0%
	Classrooms with 5 or more computers	16.7%	0.0%	0.0%	0.0%	83.3%
	Computers that were outdated and limited in capacity	100.0%	0.0%	0.0%	0.0%	0.0%
	Computers that were aging but adequate	83.3%	0.0%	16.7%	0.0%	0.0%
	Computers that were up-to-date	16.7%	0.0%	0.0%	0.0%	83.3%
	Computers with internet access	0.0%	0.0%	0.0%	0.0%	100.0%
Computer Extended	Classrooms with 1 computer	100.0%	0.0%	0.0%	0.0%	0.0%
	Classrooms with 2 - 4 computers	92.3%	0.0%	0.0%	0.0%	7.7%
	Classrooms with 5 or more computers	38.5%	0.0%	0.0%	0.0%	61.5%
	Computers that were outdated and limited in capacity	83.3%	0.0%	0.0%	0.0%	16.7%
	Computers that were aging but adequate	84.6%	0.0%	0.0%	0.0%	15.4%
	Computers that were up-to-date	46.2%	0.0%	0.0%	0.0%	53.8%
	Computers with internet access	46.2%	0.0%	0.0%	0.0%	53.8%
Extent of Computer Use						
Group		None	Few	Some	Most	All
Laptop	Computers used by					
	nearly all (91-100%) students	16.7%	0.0%	0.0%	16.7%	66.7%
	most (about 51-90%) students	100.0%	0.0%	0.0%	0.0%	0.0%
	some (about 10-50%) students	100.0%	0.0%	0.0%	0.0%	0.0%
	few (less than 10%) students	100.0%	0.0%	0.0%	0.0%	0.0%
Computer Extended	Computers used by					
	nearly all (91-100%) students	92.3%	0.0%	0.0%	0.0%	7.7%
	most (about 51-90%) students	100.0%	0.0%	0.0%	0.0%	0.0%
	some (about 10-50%) students	69.2%	0.0%	0.0%	0.0%	30.8%
	few (less than 10%) students	92.3%	0.0%	0.0%	0.0%	7.7%

Table I.3

Survey of Computer Use Data Summary for Laptop vs. Computer Extended for 7th Grade (continued)

Computer Configuration						
Group		Not Observed	Rarely	Occasionally	Frequently	Extensively
Laptop	Students worked alone at the computer	16.7%	0.0%	33.3%	0.0%	50.0%
	Students worked in pairs at the computer	66.7%	0.0%	16.7%	16.7%	0.0%
	Students worked in small groups at the computer	66.7%	0.0%	16.7%	16.7%	0.0%
	Student were computer literate	16.7%	0.0%	0.0%	16.7%	66.7%
	Students easily used the keyboard	16.7%	0.0%	0.0%	0.0%	83.3%
Computer Extended	Students worked alone at the computer	53.8%	7.7%	0.0%	7.7%	30.8%
	Students worked in pairs at the computer	84.6%	15.4%	0.0%	0.0%	0.0%
	Students worked in small groups at the computer	100.0%	0.0%	0.0%	0.0%	0.0%
	Student were computer literate	53.8%	0.0%	0.0%	0.0%	46.2%
	Students easily used the keyboard	53.8%	0.0%	0.0%	7.7%	38.5%
Production Tools Used by Students						
Group		Not Observed	Rarely	Occasionally	Frequently	Extensively
Laptop	Word Processing	16.7%	0.0%	0.0%	16.7%	66.7%
	Database	100.0%	0.0%	0.0%	0.0%	0.0%
	Spreadsheet	100.0%	0.0%	0.0%	0.0%	0.0%
	Draw/Paint/Graphics	66.7%	0.0%	0.0%	33.3%	0.0%
	Presentation (e.g., MS PowerPoint)	83.3%	0.0%	16.7%	0.0%	0.0%
	Authoring (e.g., HyperStudio)	100.0%	0.0%	0.0%	0.0%	0.0%
	Concept Mapping(e.g., Inspiration)	100.0%	0.0%	0.0%	0.0%	0.0%
	Planning (e.g., MS Project)	100.0%	0.0%	0.0%	0.0%	0.0%
Computer Extended	Word Processing	69.2%	0.0%	0.0%	0.0%	30.8%
	Database	100.0%	0.0%	0.0%	0.0%	0.0%
	Spreadsheet	100.0%	0.0%	0.0%	0.0%	0.0%
	Draw/Paint/Graphics	92.3%	0.0%	7.7%	0.0%	0.0%
	Presentation (e.g., MS PowerPoint)	100.0%	0.0%	0.0%	0.0%	0.0%
	Authoring (e.g., HyperStudio)	100.0%	0.0%	0.0%	0.0%	0.0%
	Concept Mapping(e.g., Inspiration)	100.0%	0.0%	0.0%	0.0%	0.0%
	Planning (e.g., MS Project)	100.0%	0.0%	0.0%	0.0%	0.0%
Internet/Research Tools Used by Students						
Group		Not Observed	Rarely	Occasionally	Frequently	Extensively
Laptop	Internet Browser (e.g., Netscape)	50.0%	16.7%	16.7%	0.0%	16.7%
	CD Reference (encyclopedias, etc.)	83.3%	0.0%	0.0%	0.0%	16.7%
	Communications	100.0%	0.0%	0.0%	0.0%	0.0%
Computer Extended	Internet Browser (e.g., Netscape)	61.5%	7.7%	15.4%	0.0%	15.4%
	CD Reference (encyclopedias, etc.)	100.0%	0.0%	0.0%	0.0%	0.0%
	Communications	92.3%	7.7%	0.0%	0.0%	0.0%

Table I.3

Survey of Computer Use Data Summary for Laptop vs. Computer Extended for 7th Grade (continued)

Educational Software Used by Students						
Group		Not Observed	Rarely	Occasionally	Frequently	Extensively
Laptop	Drill/Practice/Tutorial	100.0%	0.0%	0.0%	0.0%	0.0%
	Problem Solving (Oregon Trail, SimCity, etc.)	100.0%	0.0%	0.0%	0.0%	0.0%
	Process Tools (Geometer's Sketchpad, etc.)	100.0%	0.0%	0.0%	0.0%	0.0%
Computer Extended	Drill/Practice/Tutorial	100.0%	0.0%	0.0%	0.0%	0.0%
	Problem Solving (Oregon Trail, SimCity, etc.)	100.0%	0.0%	0.0%	0.0%	0.0%
	Process Tools (Geometer's Sketchpad, etc.)	100.0%	0.0%	0.0%	0.0%	0.0%
Subject Areas of Computer Activities						
Group		Other	Language Arts	Mathematics	Science	Social Science
Laptop	Production Tools	0.0%	20.0%	20.0%	0.0%	60.0%
	Internet/Research Tools	0.0%	33.3%	33.3%	0.0%	33.3%
	Educational Software	0.0%	0.0%	0.0%	0.0%	0.0%
Computer Extended	Production Tools	100.0%	0.0%	0.0%	0.0%	0.0%
	Internet/Research Tools	50.0%	16.7%	0.0%	0.0%	33.3%
	Educational Software	100.0%	0.0%	0.0%	0.0%	0.0%